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JULY 24, 1986

22 SEP REC'D

EDN

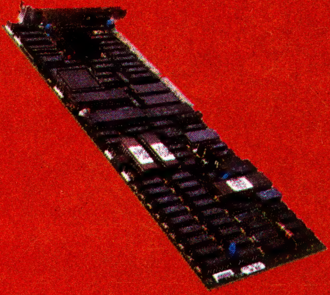
SPECIAL ISSUE—Part 2
Product Showcase No 23

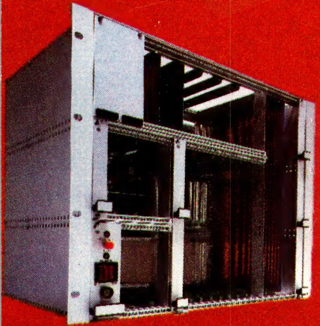
Highlighting key trends in computers & peripherals, components, instruments, and products from Europe

Expanded literature section

ELECTRONIC TECHNOLOGY FOR ENGINEERS AND ENGINEERING MANAGERS

Showcase





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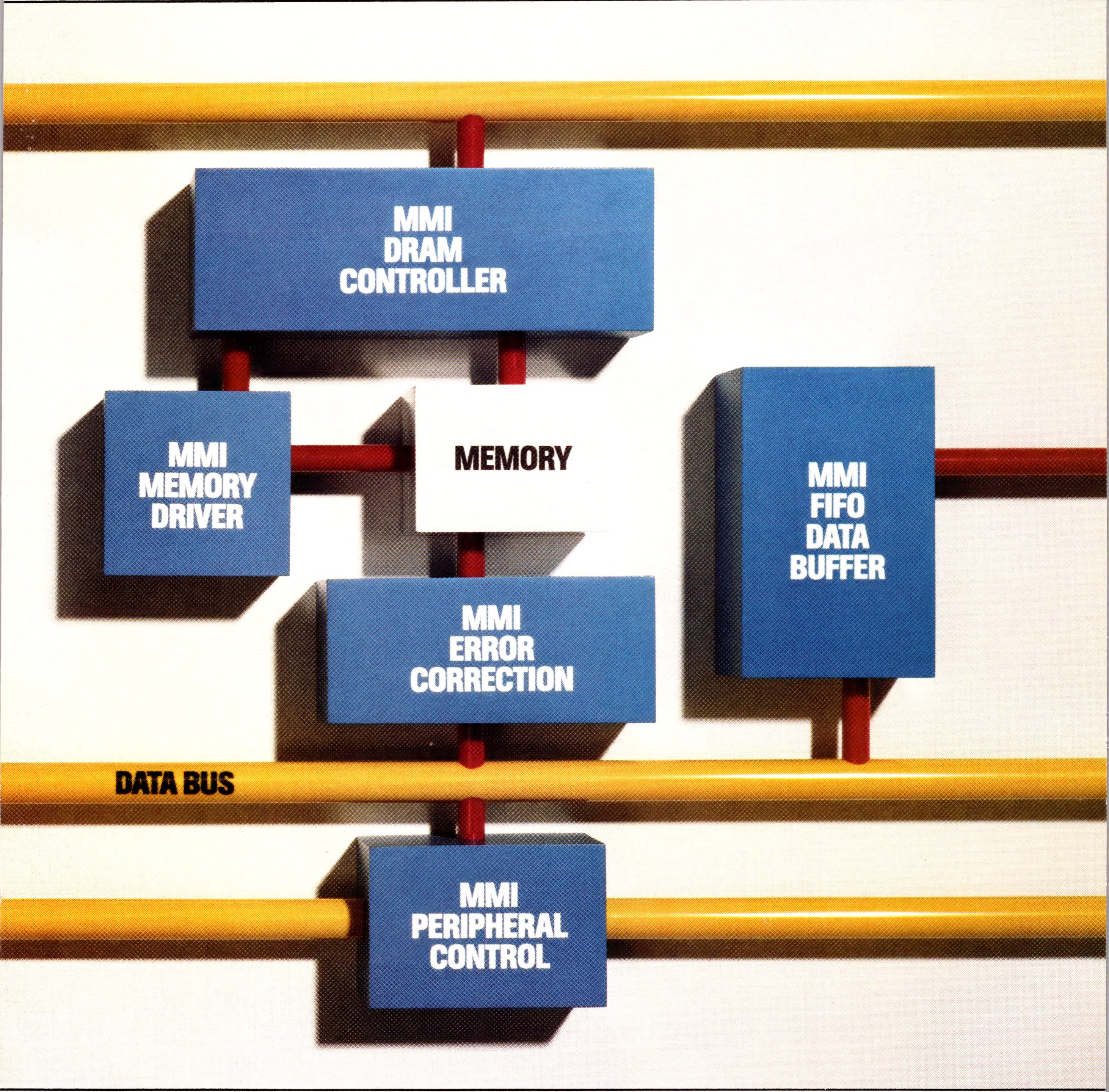
Monolithic Memories MMI



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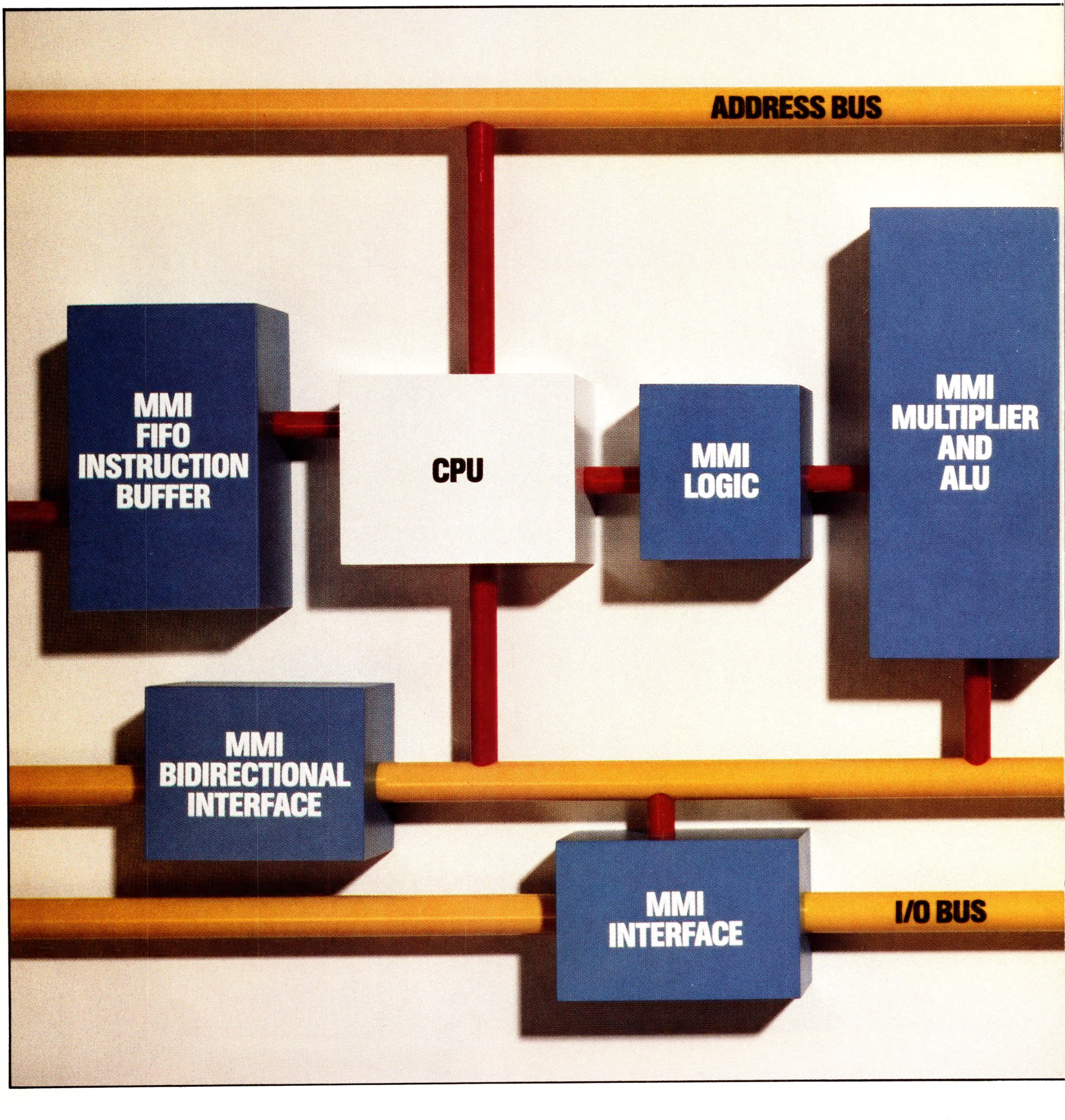

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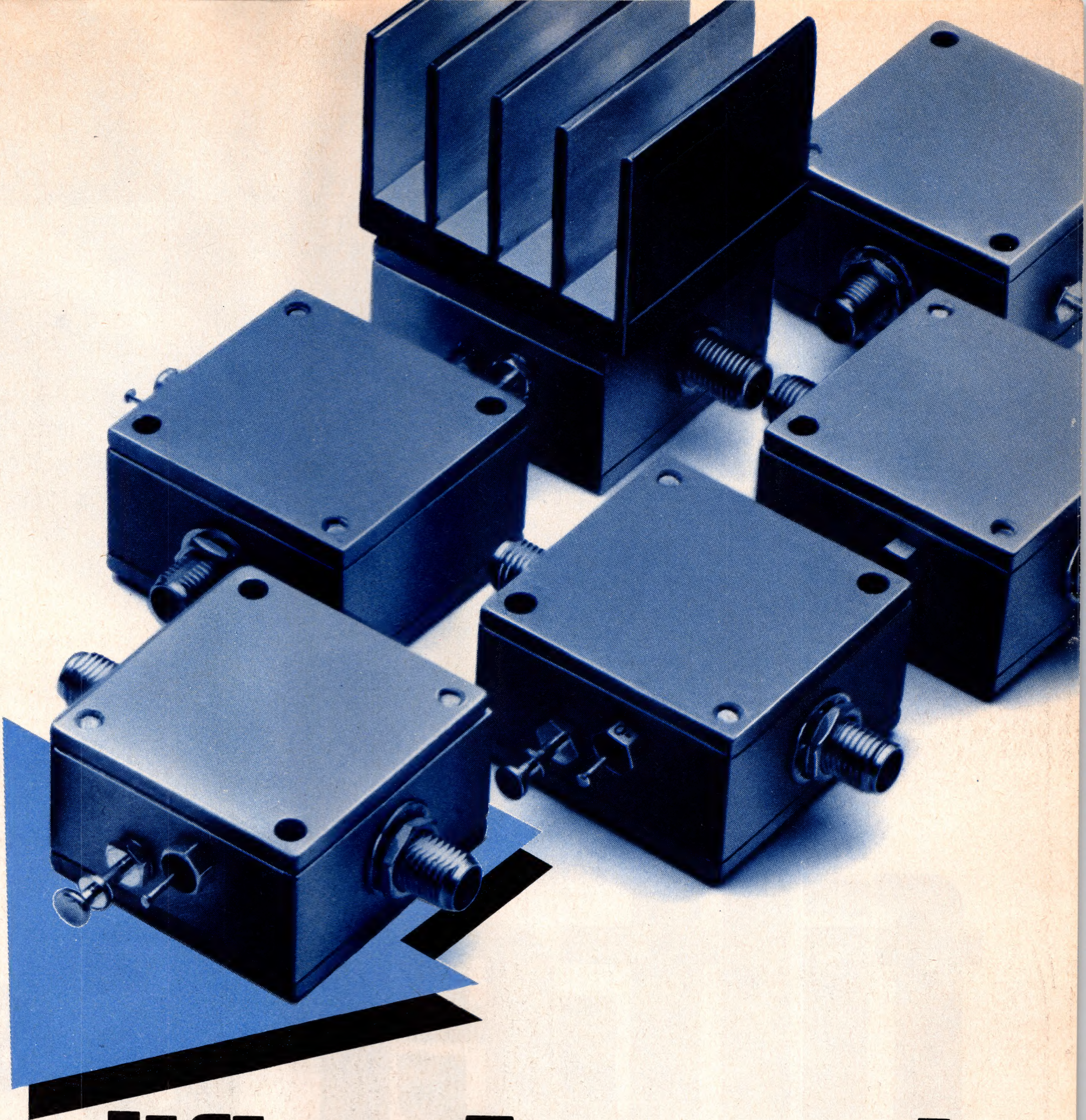

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Gain Flatness (dB) Max.	±1.0	±1.5	±1.5	±1.0
Max. Power (dBm) (1dB compression)	+10	+3	+17*	+20
NF (dB) typ.	5.3	12.0	7.0	5.0
3rd order Intercept pt (dBm)	+18	+13	+25	+33
Current at 15V dc	80mA	90mA	100mA	150mA
Price $	69.95	199	179	219
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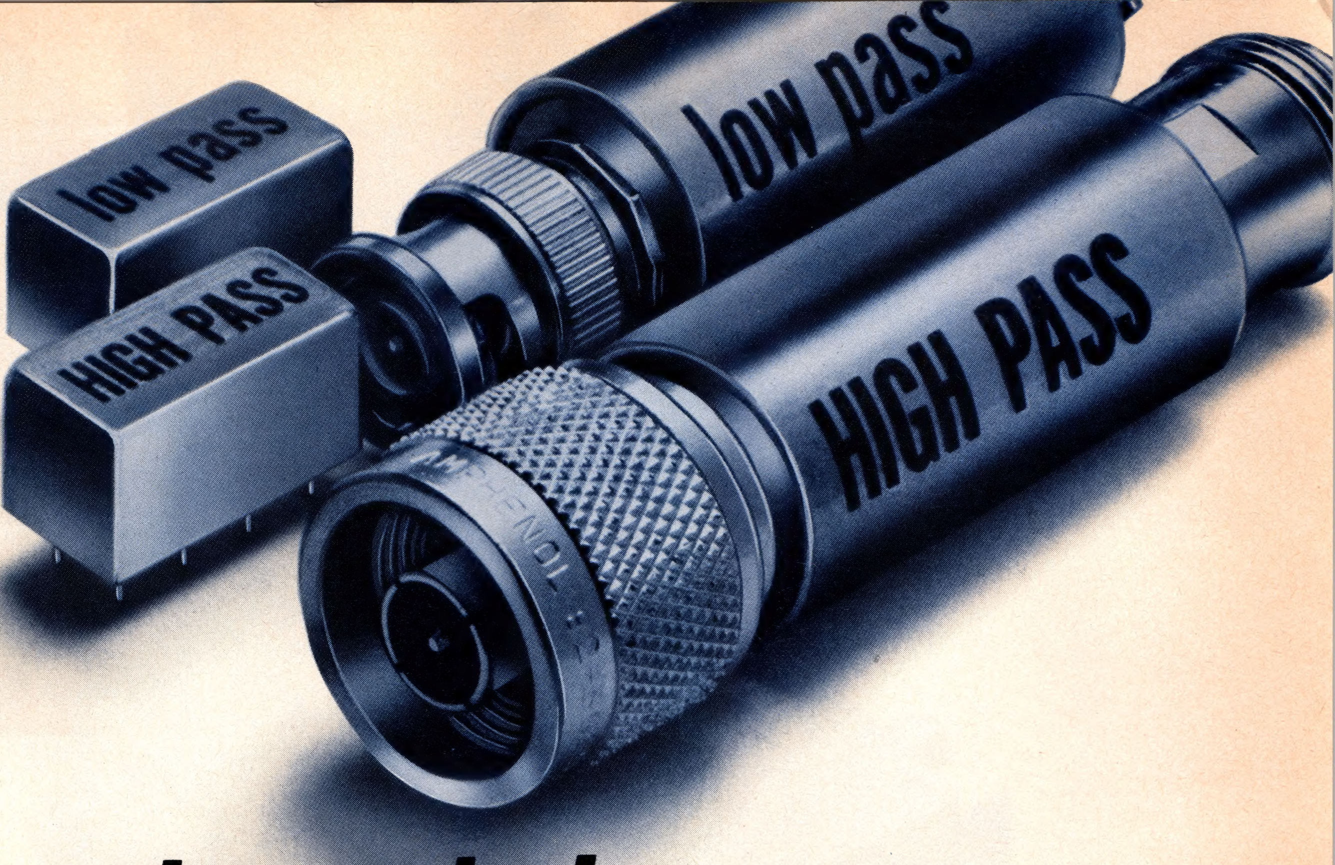
C101 REV. A



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LOW PASS **Model** *LP–	**10.7**	**50**	**100**	**150**	**200**	**300**	**450**	**550**	**600**	**750**	**850**	**1000**
Min. Pass Band (MHz) DC to	10.7	48	98	140	190	270	400	520	580	700	780	900
Max. 20dB Stop Frequency (MHz)	19	70	147	210	290	410	580	750	840	1000	1100	1340

Prices (ea.): P $9.95 (6-49), B $24.95 (1-49), N $27.95 (1-49), S $26.95 (1-49)

HIGH PASS **Model** *HP–		**50**	**100**	**150**	**200**	**300**	**400**	**500**	**600**	**700**	**800**	**900**	**1000**
Pass Band (MHz)	start, max.	41	90	133	185	290	395	500	600	700	780	910	1000
	end, min.	200	400	600	800	1200	1600	1600	1600	1800	2000	2100	2200
Min. 20dB Stop Frequency (MHz)		26	55	95	116	190	290	365	460	520	570	660	720

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*Prefix P for pins, B for BNC, N for Type N, S for SMA *example:* **PLP-10.7**

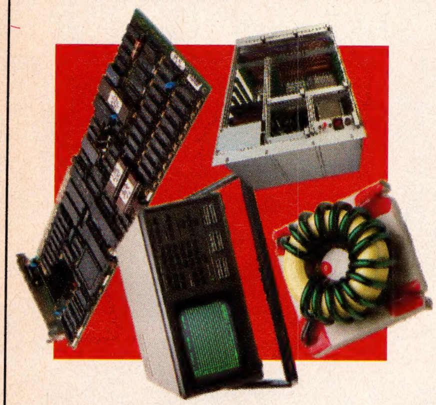
C105 REV. A

Volume 31, Number 15

EDN

July 24, 1986

ELECTRONIC TECHNOLOGY FOR ENGINEERS AND ENGINEERING MANAGERS



On the cover: *This showcase issue's Computers and Peripherals coverage leads off with a report on single-board implementations of IBM PC and PC/AT computers, illustrated on the cover by a single-board computer from Faraday Electronics. See pg 64. The cover's depiction of a high-performance logic analyzer from Philips Test and Measuring Instruments Inc illustrates the focus of the staff report (on pg 118) that introduces this showcase's Instruments section. The Products from Europe staff report on pg 162 discusses enclosures, from companies including BICC-Vero, for Eurocard pc boards. Finally, the Components section (pg 188) begins with a look at surface-mount inductors and transformers, such as the one from Coilcraft pictured on the cover. (Cover concept by Debi Queally; photography by Gerry Baskin)*

DESIGN FEATURES

Computers and Peripherals

Single-board computers support PC and PC/AT bus 64

If you want to take advantage of the wealth of software and hardware available for the IBM PC and compatibles, but your intended system is constrained by physical limitations, you should consider using a single-board computer with a PC- or PC/AT-bus passive backplane.—*Margery S Conner, Regional Editor*

Instruments

Timing analyzers keep pace with high-speed logic 118

You can choose from a range of fast timing logic analyzers to debug today's complex, high-speed logic circuits. Several logic analyzers let you view your circuit's logic timing with 2.5-nsec resolution, and two analyzers actually provide subnanosecond resolution.—*Chris Everett, Regional Editor*

Products from Europe

Eurocard packaging suits a wide range of plug-in modules 162

Eurocard mechanical standards let you implement modular electronic assemblies by using pc-board plug-ins from a variety of manufacturers. When you adopt a Eurocard-based system, you can choose from a wide variety of packaging components that are compatible both with the pc boards and with each other.—*Peter Harold, European Editor*

Components

Lack of standards breeds diversity in SMD inductors 188

Standards for surface-mount inductors have been slow to appear, so you must take care when selecting parts from more than one vendor. The wide variety of components available can meet your application and cost requirements if you know which specifications are critical to that application.—*Steven H Leibson, Regional Editor*

Continued on page 7

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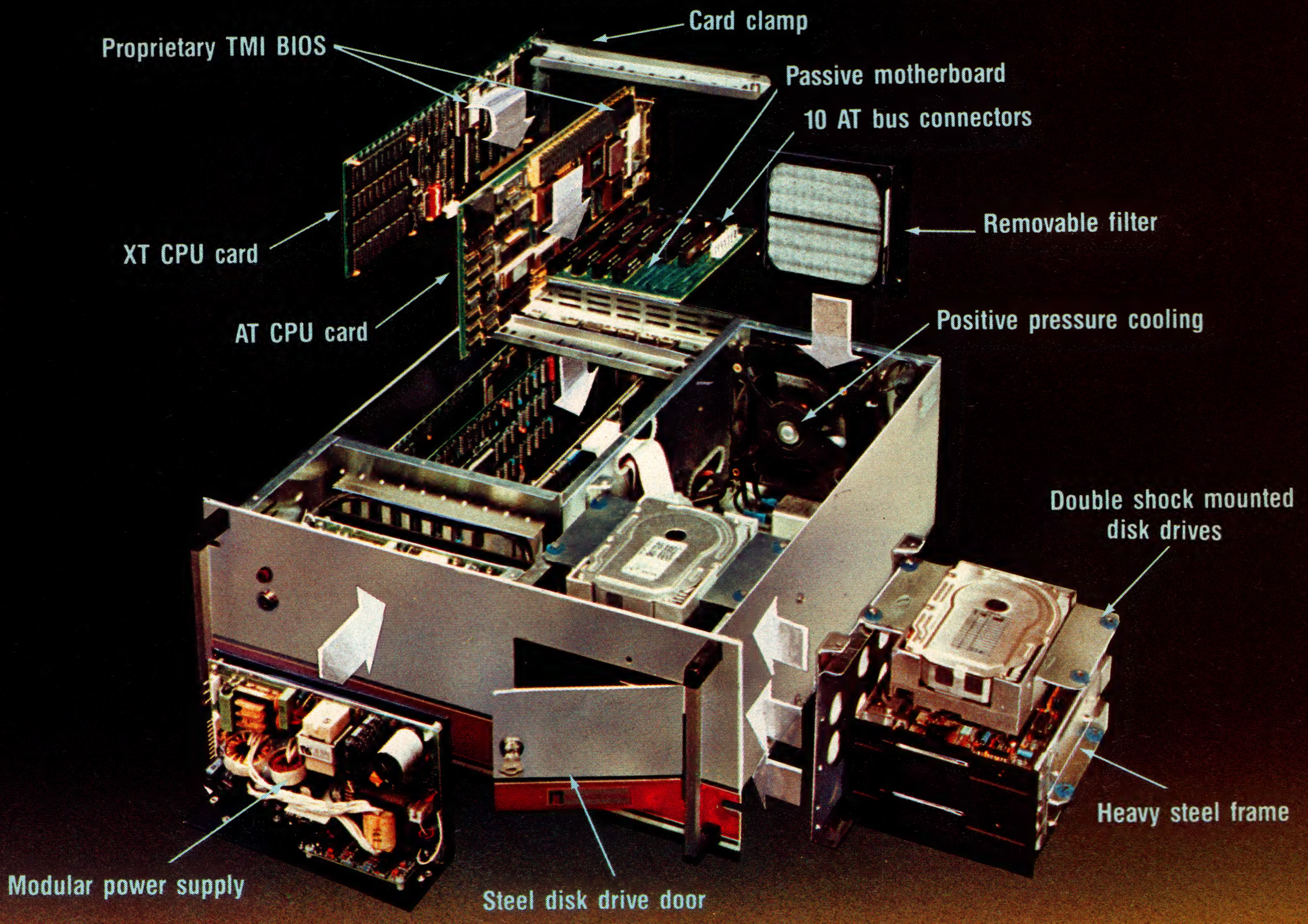

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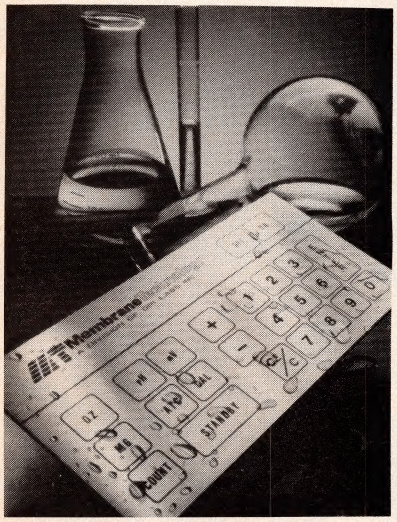

This showcase issue highlights significant new products in four areas: Computers and Peripherals (pg 81), Instruments (pg 135), Products from Europe (pg 175), and Components (pg 199).

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EDN's editors depend on you, our readers, to provide ideas for topics that interest you. We invite you to offer your suggestions.

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Learning to write well helps engineers overcome anxieties about communicating.—*Deborah Asbrand, Staff Editor*

LOOKING AHEAD 273

Keyboard sales to exceed $1.5 billion in 1990 . . . Publishing systems sales to top $7 billion by 1989.

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A product-oriented design aid

To save you time in your efforts to keep current, EDN's editors have surveyed the new-product offerings from thousands of companies, screening and selecting only the most significant of those offerings introduced in the last six months. We present our findings—the best of the best—in a format designed to make your product selection as easy as possible. You can use this Product Showcase as a reference until the next one that covers these four key product areas appears in December.

BPA ABP

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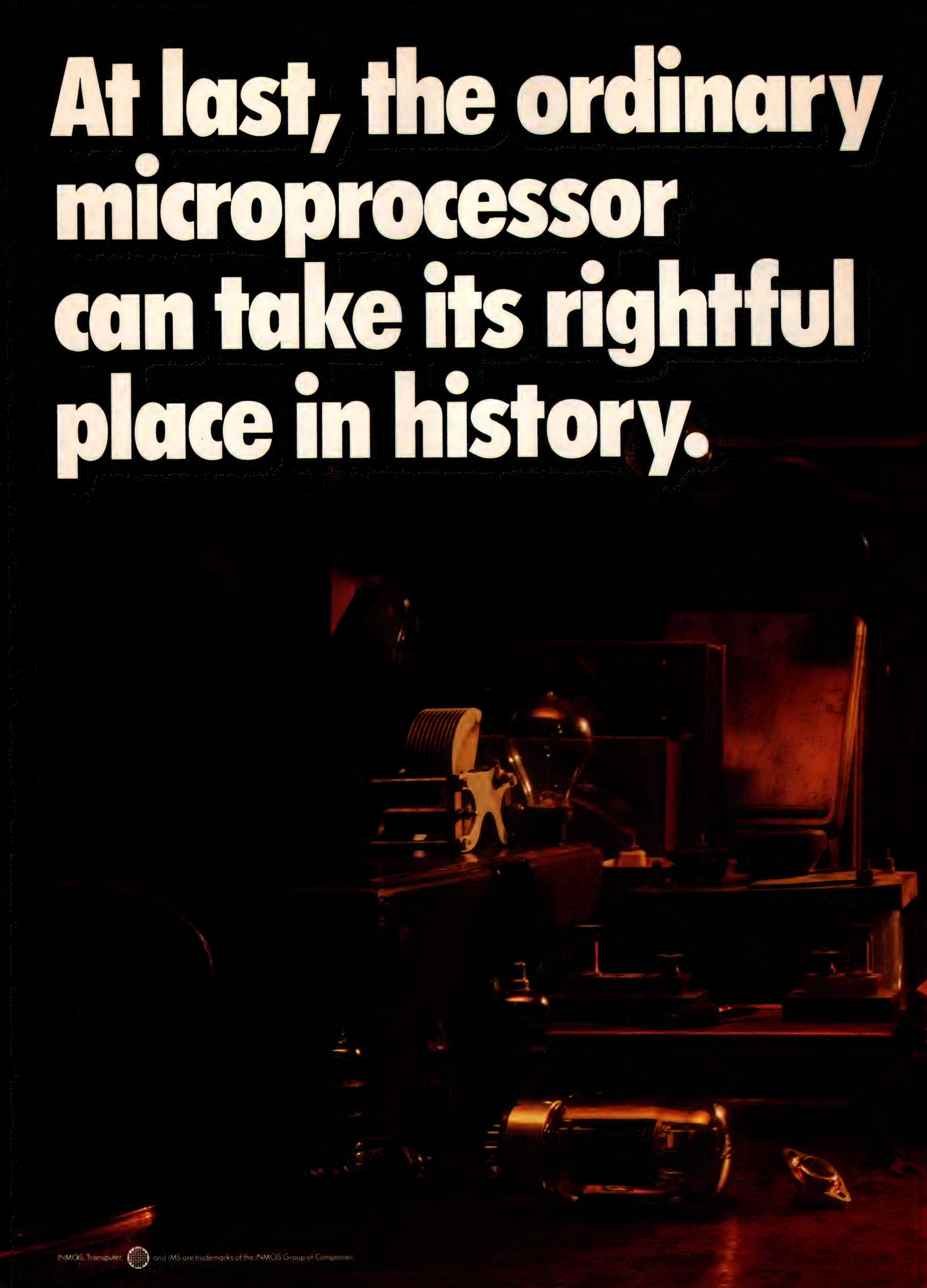
At last, the ordinary microprocessor can take its rightful place in history.

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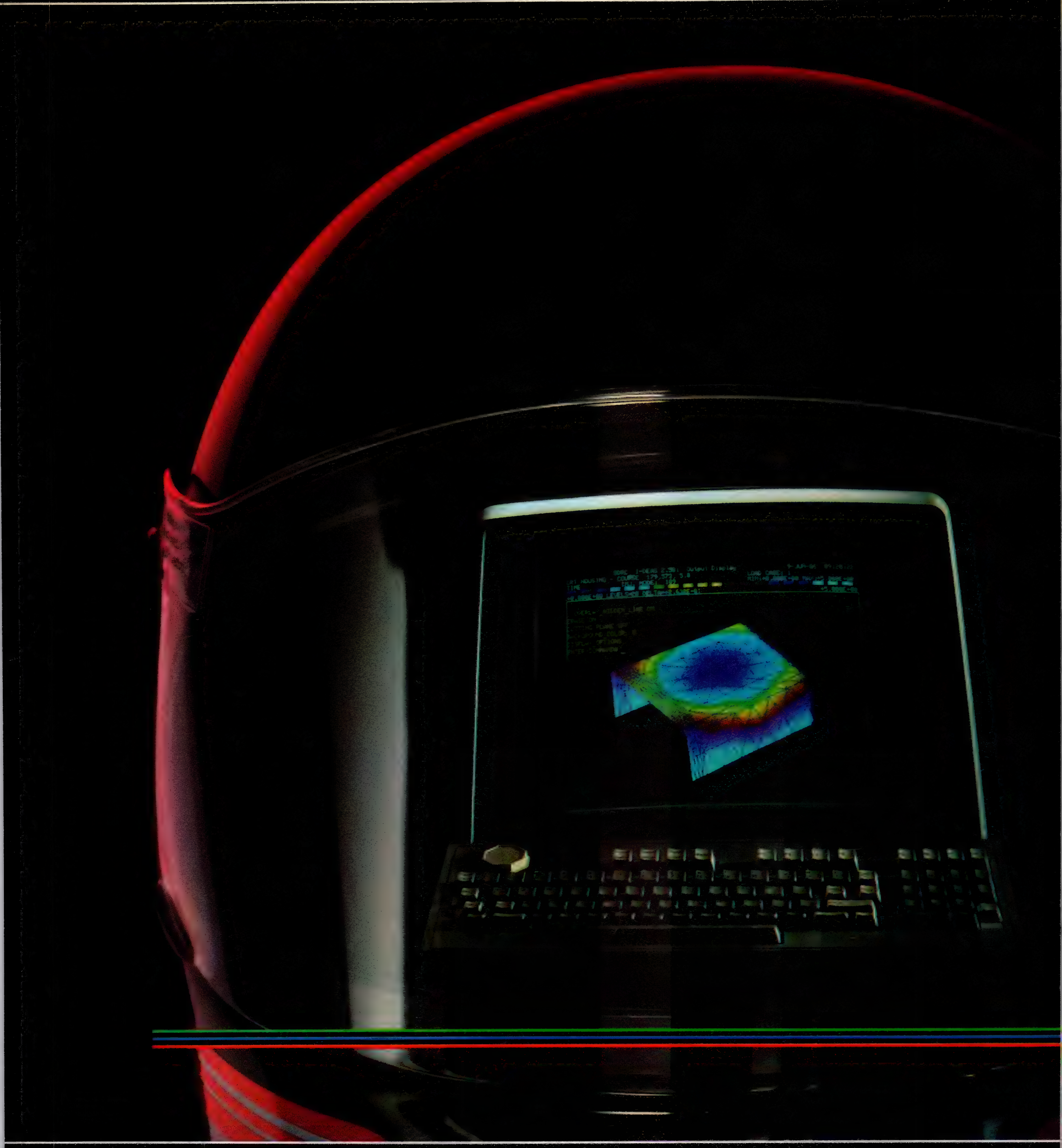

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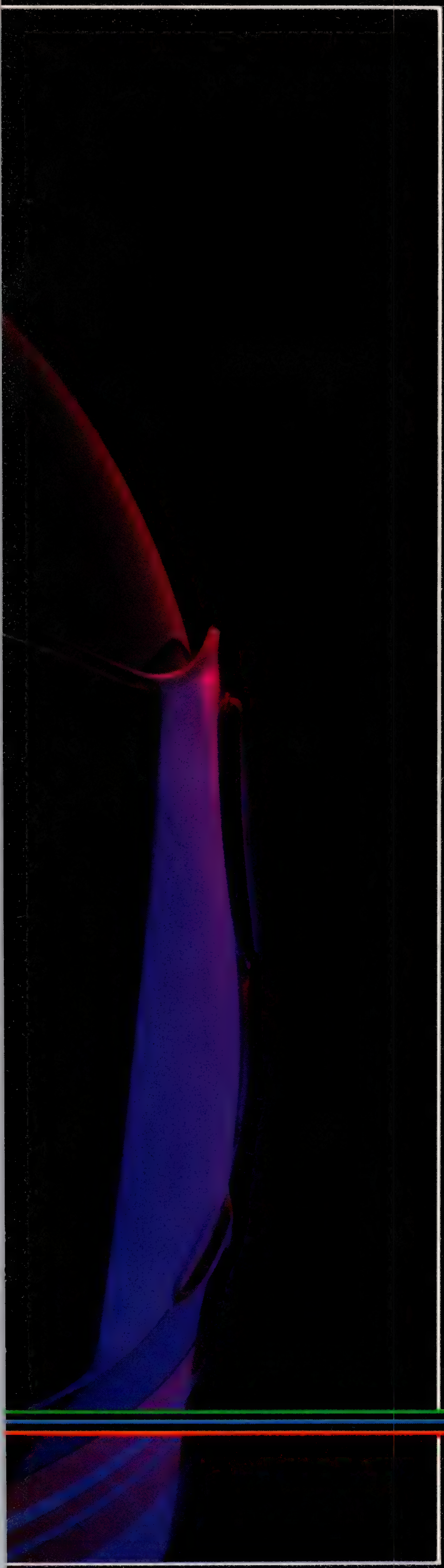

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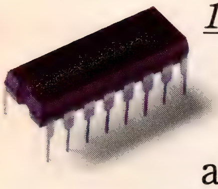

1 Mb Dynamic RAMs

We're a leader in volume production of 1 Mb DRAMs and also 256K DRAMs. If you are thinking powerful memory, talk with us.

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ROMs in NMOS and CMOS

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EPROMs in NMOS and CMOS

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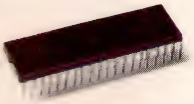

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Toshiba offers a CMOS Z-80® MPU and peripherals that are hardware and software compatible with the Z-80 family, and they are second sourced.

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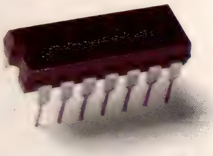

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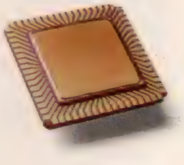

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NEWS BREAKS

EDITED BY JOAN MORROW

SEEQ INTRODUCES FIRST FLASH EEPROM

Based on a proprietary single-cell NMOS design, the 16k-byte 48128 QPROM (quickly erasable PROM) from Seeq Technology (San Jose, CA, (408) 942-1990) performs a bulk (flash) erase of all on-chip memory locations in just 20 sec. The flash-erase mode is initiated by raising the V_{PP} programming pin to 21V and toggling the A_3 address pin. During normal operation, the EEPROM device runs from one 5V supply and has a read access time of 200 nsec. It can also be programmed like a typical EEPROM with a write time of 2 msec/byte typ. Seeq sells the $6 (100) 48128 in a 28-pin cerdip that conforms with the JEDEC-approved footprint for byte-wide EEPROMs.—Denny Cormier

5¼-IN. WINCHESTER OFFERS 360M BYTES AND EMBEDDED SCSI

Providing the highest storage capacity of any 5¼-in. SCSI drive, the 360M-byte XT-3380 from Maxtor Corp (San Jose, CA, (408) 942-1700) features a bus-transfer rate of 1.5M bytes/sec max and 1:1 interleaving. The XT-3380 implements the full SCSI command set, including arbitration and disconnect/reconnect commands. Its single circuit board furnishes a miniaturized SCSI chip set and surface-mount devices. The XT-3380 sells for $3800 (OEM qty).—J D Mosley

SOFTWARE PACKAGES SUPPORT PC DATA-ACQUISITION CARDS

Two packages from Burr-Brown Corp (Tucson, AZ) support the company's PCI-20000 data-acquisition system of carrier cards and modules (see EDN, June 12, 1986, page 116) for the IBM PC computer family. The PCI-20046S-2 and PCI-20046S-3 both offer high-level-language calls to assembly-level routines that configure, read from, and write to the PCI-20000 for the C and Turbo Pascal programming languages, respectively. The packages also provide linearization and cold-junction compensation routines for J, K, and T thermocouples and linearization for RTDs. The software packages each cost $225; you can obtain a demo disk by calling Rick Porter at (602) 746-1111.—Steven H Leibson

SIGNAL-PROCESSING CHIP PERFORMS COMPLEX FLOATING-POINT FFTs

Using on-chip RAM and ROM together with a 16-bit architecture optimized for digital-signal-processing operations, the ZR34161 Vector Signal Processor (VSP) IC from Zoran Corp (Santa Clara, CA, (408) 773-3500) can compute complex floating-point FFTs containing 128 points in less than 250 μsec or 1024 points in under 3 msec when driven by a 20-MHz clock. The chip also handles such vector operations as correlations, sine/cosine transforms, matrix manipulations, and power-spectrum computations. Although the device can drive TTL logic, its low-power CMOS construction restricts power dissipation to less than 500 mW. The company supplies the part in a 48-pin DIP for $700 (100).—Denny Cormier

COMPANY WILL MANUFACTURE OUT-OF-PRODUCTION GOLD-DOPED ICs

Military procurers and subcontractors can go to Polycore Electronics (Newbury Park, CA, (805) 499-6777) to obtain hard-to-find or out-of-production gold-doped ICs, particularly RTL, TTL, and DTL families. To receive a replacement part, you merely supply Polycore with the generic part number or the original manufacturer's data sheet. The company will then produce form, fit, and function replacements in complete packages or die form.—Joan Morrow

NEWS BREAKS

SINGLE-DEVICE MODEM IS DESIGNED FOR PERSONAL FAX MACHINES

The R24MFX Monofax is a single-device 2400-bps facsimile modem from the Semiconductor Products Div of Rockwell International (Newport Beach, CA, (714) 833-4700). Housed in a 64-pin, quad-in-line package, the device can generate diagnostic line-quality data and support adaptive equalization, a procedure that automatically compensates for line-quality distortions. It supports the CCITT Recommendation V.27 ter fallback mode (2400 bps) and the V.21 channel 2 mode (300 bps). The R24MFX offers two DTE interfaces, a parallel microprocessor bus interface, and a CCITT V.24/RS-232C port. Power consumption is 1W typ. The device costs $40 (1000).—Margery S Conner

JEDEC PLASTIC CHIP-CARRIER SOCKETS EASE PRODUCTION

A family of sockets for JEDEC plastic chip carriers (PCCs) from 3M Corp (Austin, TX, (512) 834-6563) is suited for production requirements. These sockets offer visual and mechanical polarization to ensure proper alignment of your PCC device to the socket and the socket to your circuit board. To aid your testing process, each contact in the sockets has 0.026-in. probe holes for above-board access. Available in 44-, 52-, 68-, and 84-lead versions, the sockets are made of glass-reinforced modified polyethylene teraphthalate, and the nickel/silver alloy contacts have tin/lead plating. Contacts are on 0.05-in. spacing with pinouts on a 0.1×0.1-in. grid. A 68-lead socket costs $2.65 (25,000).—J D Mosley

256k-BIT MILITARY CMOS EEPROM COMES IN 28-PIN JEDEC DIP

The MIL-spec DPE41257T 256k-bit CMOS EEPROM module from Dense-Pak Microsystems Inc (Garden Grove, CA, (714) 898-0007 is configured as 32k×8 bits. It comes in a JEDEC 28-pin ceramic DIP and is also available in 16k×8- and 24k×8-bit versions. Access and byte-write times are 150 nsec and 200 μsec (max), respectively. The company claims that a monolithic military equivalent will not be available for 12 months. The DPE41257T costs $850 (100).—Margery S Conner

SEPTEMBER DISK TESTING CONFERENCE ADDS VENDOR DISPLAYS

Disk/Test '86 will be held on September 19, 1986, at the Sunnyvale, CA, Hilton. The Technology Assessment Group Inc (Santa Barbara, CA, (805) 687-3844) sponsors the conference, which features morning tutorial presentations on disk technology and afternoon sessions on disk testing and repair, followed by exhibits of disk-testing equipment. Registration for Disk/Test '86 is $250.—Steven H Leibson

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CIRCLE NO 26

NEWS BREAKS: INTERNATIONAL

EDITED BY JOAN MORROW

8.8-IN. MAGNETIC-DISK-DRIVE SYSTEM STORES 1050M BYTES

The DK815-10, an 8.8-in. magnetic-disk-drive system from Hitachi Ltd, features a 1050M-byte storage capacity. The system is available in samples to US and Japanese OEMs for $14,700 and ¥2,400,000 ($14,118), respectively. The company achieves the density through the use of thin-film heads, improved coated disks, and low-noise read/write microcircuits. It plans to sell 30,000 systems during the next five years.

256k-BIT STATIC RAMs HAVE 100-, 120-nSEC ACCESS TIMES

Two 256k-bit static RAMs—one with a 100-nsec access time and the other with a 120-nsec access time—are organized as 32k words×8 bits. Fabricated using a 1.2-μm design rule, the standard model consumes 40 mA during operation, and the low-power version consumes 13 mA. The memories, from Seiko Epson, cost ¥4000 ($23.53) to $29.40. This company will be one of the major suppliers of 256k-bit static RAMs: It started production of the devices at a rate of 400,000 pieces a month and will increase the rate to a million pieces by the end of the year.

TELEPHONE AUTOMATICALLY DIALS FROM VOICE COMMANDS

Sanyo Electric Co has developed a telephone that automatically dials a number by voice command and, according to the company, has greater than 99% accuracy. Sanyo expects to release the phone commerically in the near future. The speaker-dependent voice-recognition system can respond to as many as four voices; each person can register as many as 20 numbers. A single user can register 80 numbers.

5-IN. OPTICAL DISK SYSTEM IS DESIGNED FOR PCs

Later this year, Ricoh Co will introduce a 5-in. optical-disk-drive system for personal computers that should sell for approximately ¥500,000 ($3030). The direct read after write system measures 46×208×82 mm. The 135×153×9-mm disk cartridge should sell for approximately $30 each. The front-loading disk drive furnishes a 0.1-sec information-retrieval time.

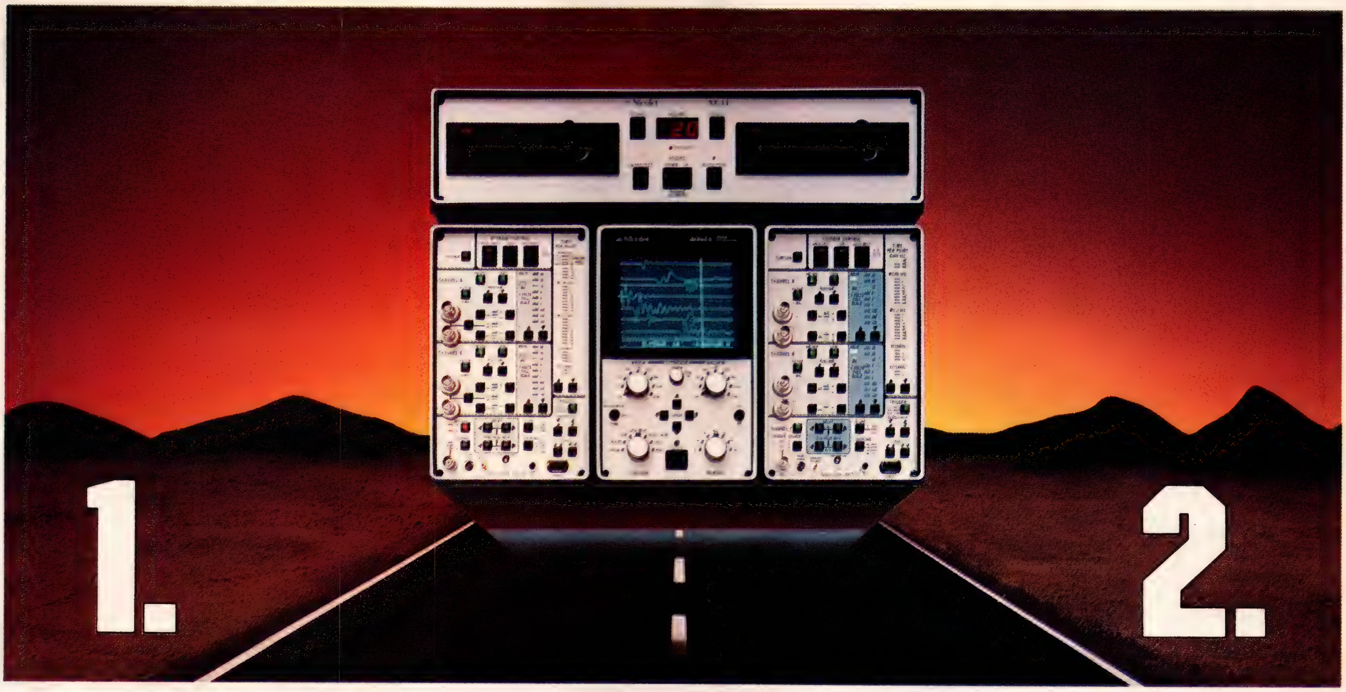
TECHNOLOGY DEVELOPED FOR 4M-BIT DYNAMIC RAMs

Mitsubishi Electric's LSI Laboratory has developed a memory-cell technology that could aid in the manufacture of 4M-bit dynamic RAMs. The process shortens the distance between the cells and reduces the number of soft errors. It calls for etching vertical trench cells that are 1- to 1.5-μm in diameter and about 3 to 4 μm deep onto a silicon wafer's surface, then surrounding the cells with p and n layers. By adopting a double-layer insulator structure of oxide and nitride films, the company has held down the leak current considerably and improved the soft-error rate more than tenfold. Mitsubishi plans to use this technology to develop a prototype of a 4M-bit dynamic RAM by the end of the year and will submit papers on the topic next spring to the International Solid State Circuits Conference.

FLOPPY-DISK DRIVE DESIGNED FOR 2½-IN. DISKS

The FDU-250 2½-in. floppy-disk drive from Sanyo Seiki Mfg weighs 280g and is approximately half the size of 3½-in. systems. The disks can store 64k bytes per side formatted. Samples of the drive are available for ¥40,000 ($242).

THE FIRST NAME IN DIGITAL SCOPES



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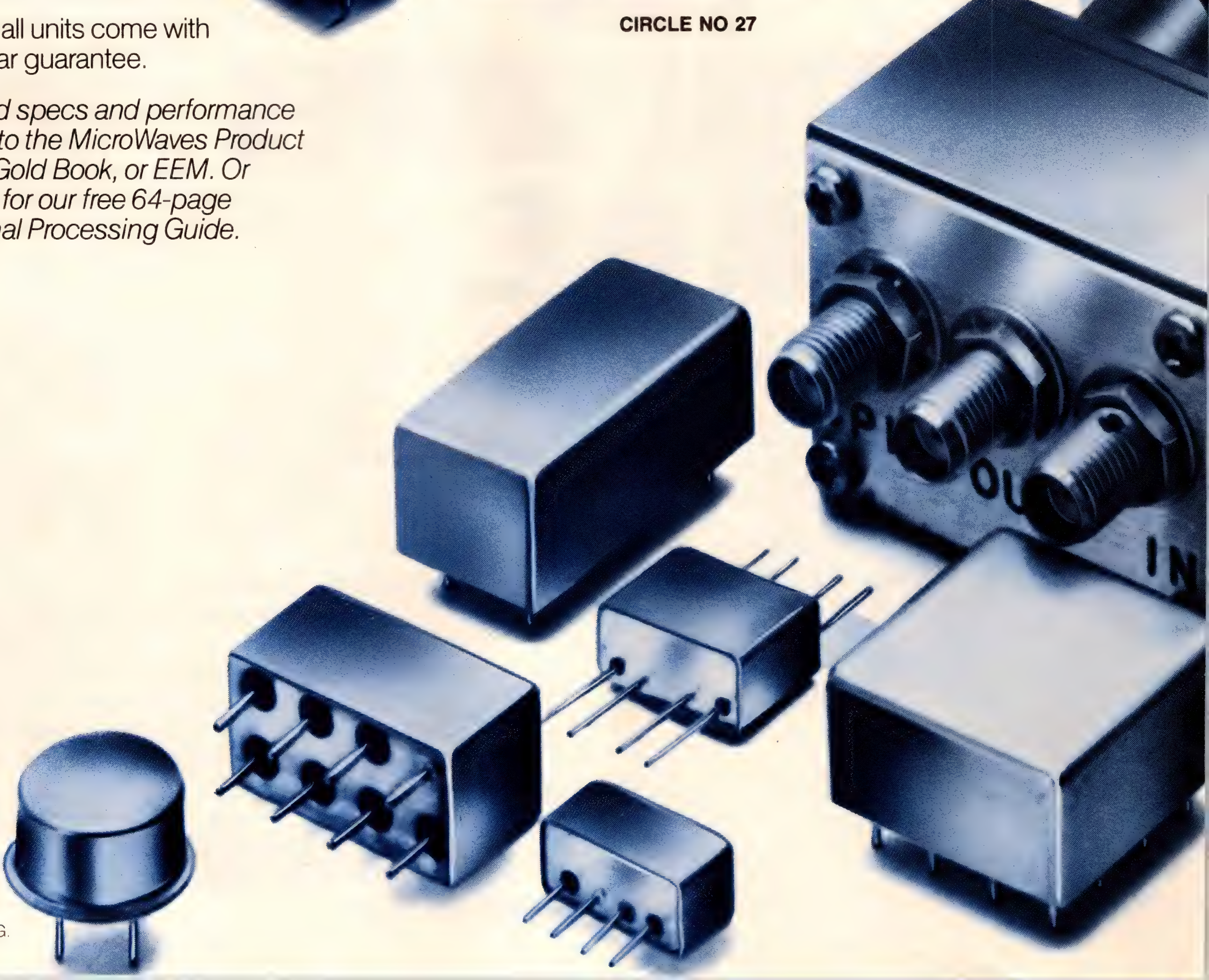

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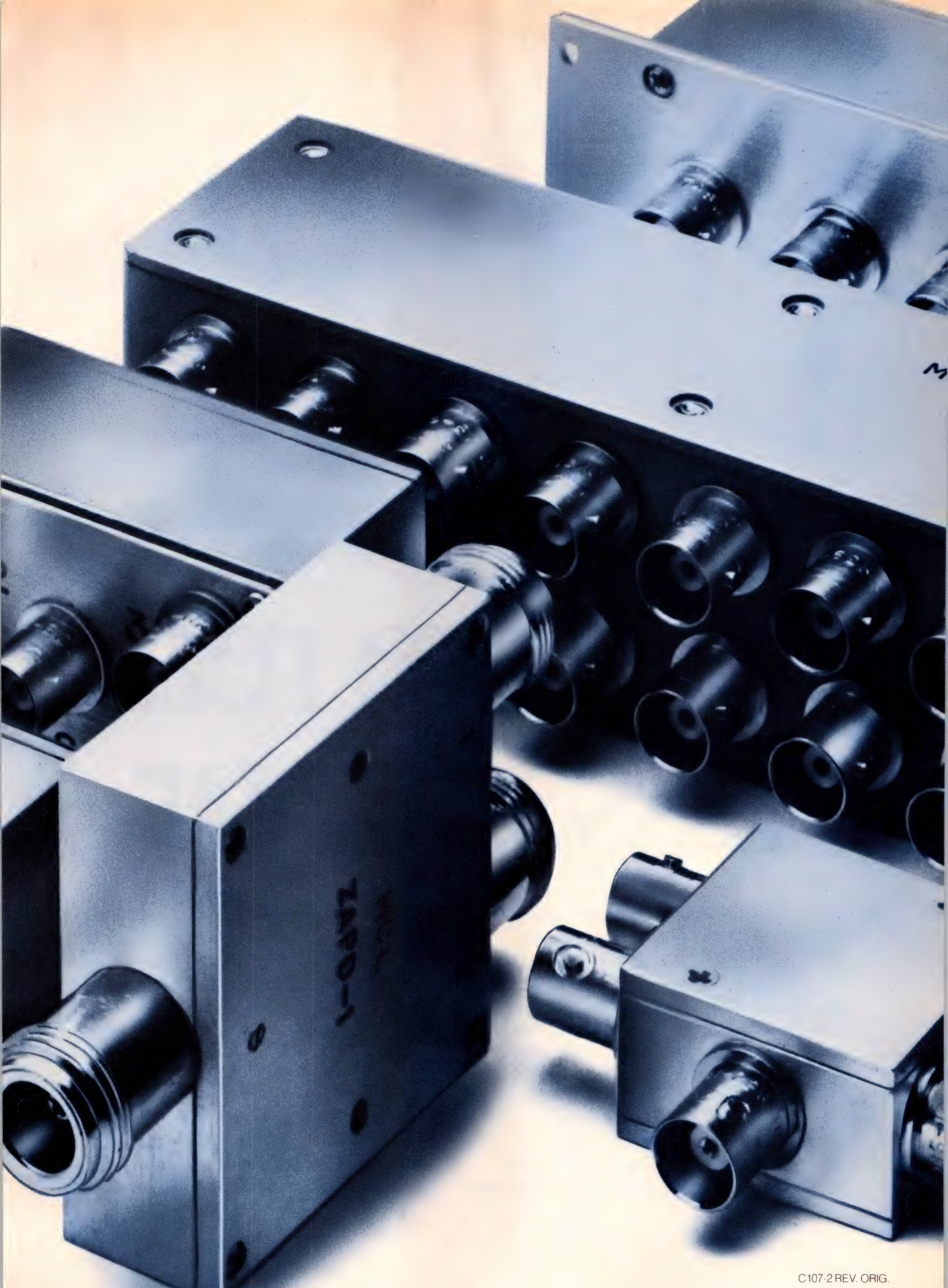
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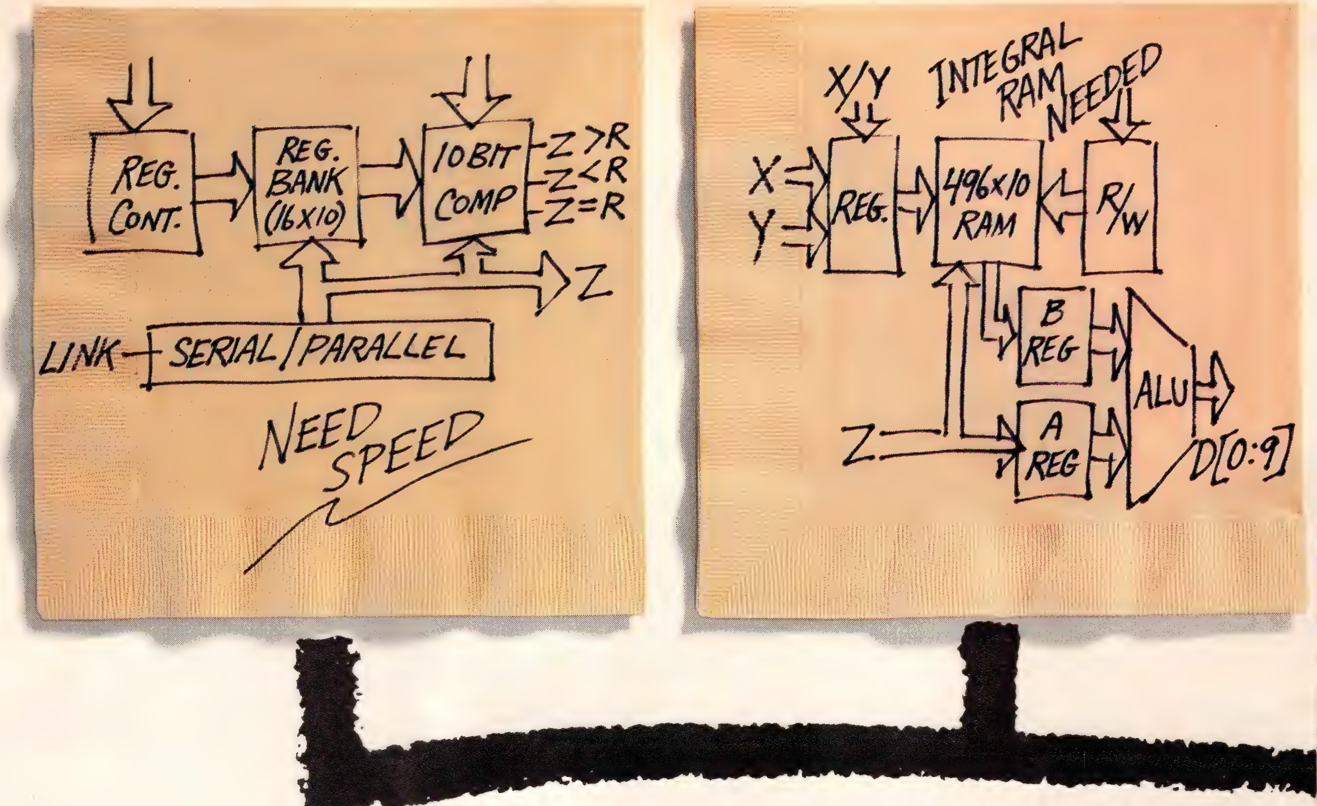

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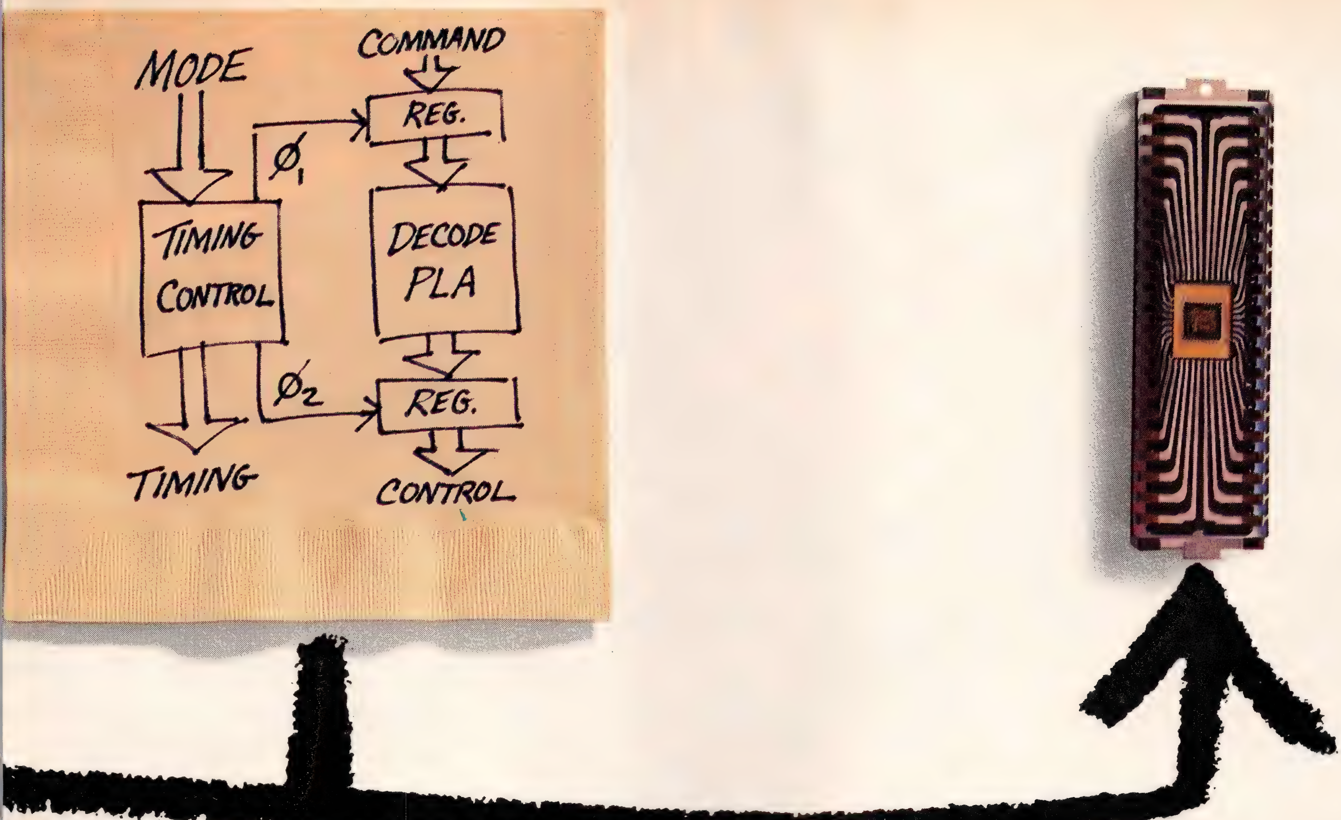

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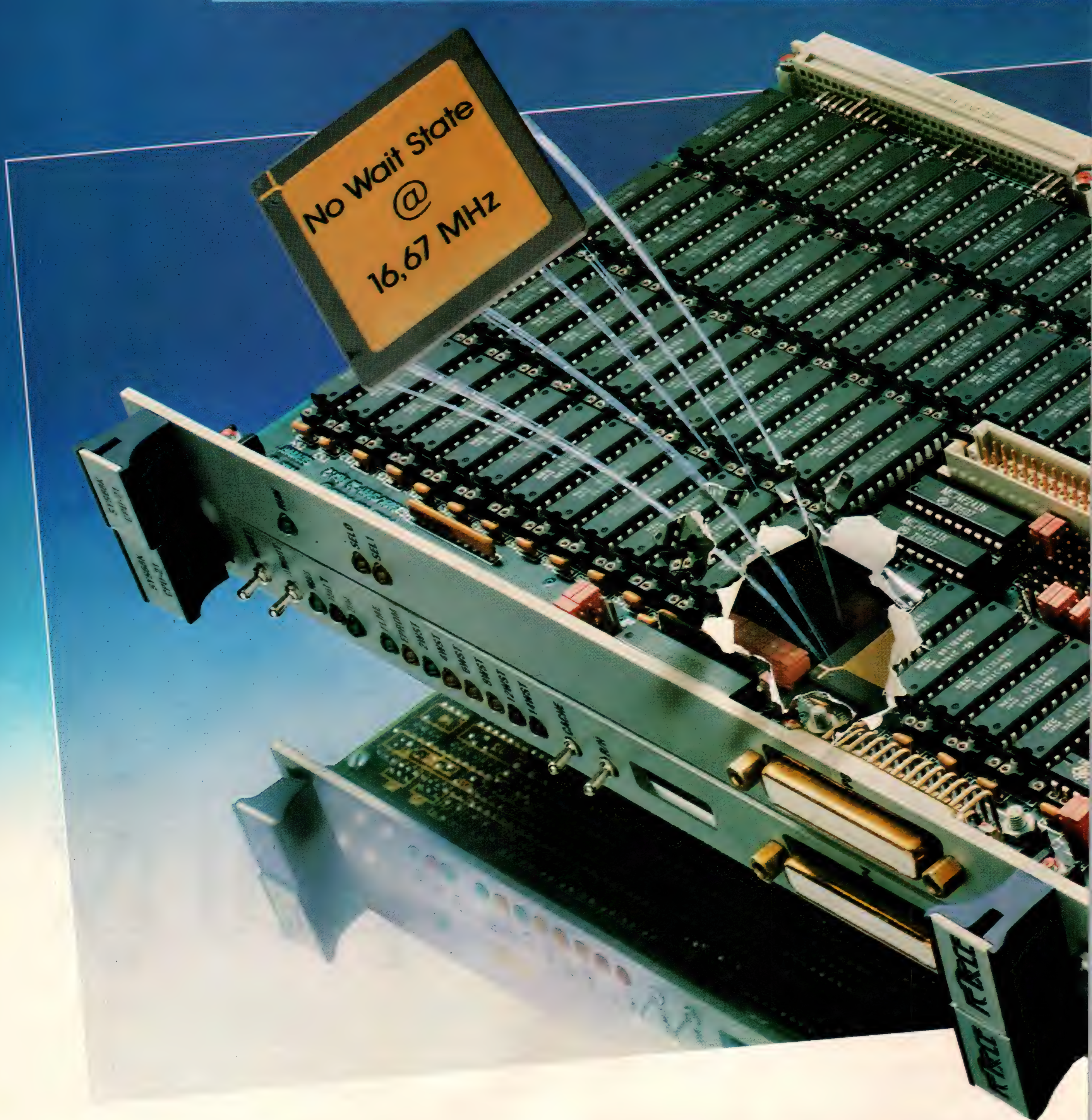

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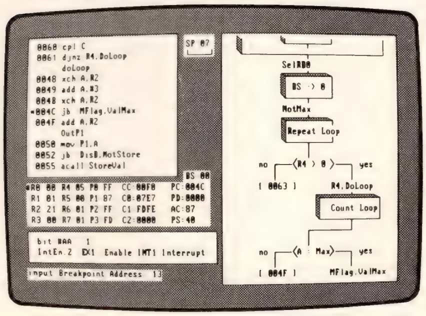

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CIRCLE NO 29

SIGNALS & NOISE

Editorial was an attention-getter

Dear Editor:

I wish to thank Rick Nelson for his editorial "Getting the (male) engineer's attention" (EDN, April 17, pg 51). I find it encouraging that your magazine has confronted the ongoing problem of negative representation of women in advertising. I commend Mr Nelson's direct analysis of the issue, and I hope that his refutation of these all-too-common justifications for objectifying, patronizing, and exploiting women has awakened at least one patron of your magazine to the realities of the society we live in.

I thank Mr Nelson for his supportive analysis of a problem that plagues both women and men alike, and for expressing this attitude in a publication directed at an area of business that remains dominated by men.

Sincerely yours,
Kelly D Thompson
Phoenix, AZ

Graphics terminals support MicroVAX II

Dear Editor:

I would like to respond to Eva Freeman's article "CAE-software packages adapt easily to the MicroVAX II 32-bit computer," (EDN, November 28, 1985, pg 61). The article states that "... Megatek ... systems are currently incompatible with the MicroVAX II ...."

In fact, Megatek was the first graphics-terminal vendor to announce support for the MicroVAX II. Since that announcement (during Siggraph '85), the company has expanded its MicroVAX II support to its entire line of graphics terminals, including the 1600, 3300, 7200, and 9200. Additional interfaces will soon be announced.

Sincerely yours,
Evelyn Szabo
Manager, Corporate Communications
Megatek Corp
San Diego, CA

(*Ed Note:* *Megatek does offer two products, the Whizzard 3300 Series and the 9200 Series, that combine MicroVAX II workstations with Megatek terminals. However, at the time the article was written, the products were available from Megatek only as bundled systems. In other words, you couldn't buy a Megatek terminal and interface it to your own MicroVAX II. We regret omitting the bundled Megatek/MicroVAX II systems from the article.*)

Corrections

In the Design Idea entitled "Dual one-shot forms frequency discriminator" (EDN, April 17, pg 241), each colored box in **Fig 2** should include **Fig 1**'s circuit instead of a ½CD4098.

Please also note the following corrections to the table accompanying the article "Digitizing tablets offer choices of formats, operating modes, and pointers" (EDN, April 17, pg 69). Besides the two sizes listed, the MM Series from Summagraphics includes a 12×18-in. tablet. Prices for the three MM Series tablets range from $395 to $999.

YOUR TURN

EDN's Signals and Noise column provides a forum for readers to express their opinions on issues raised in the magazine's articles or on any topic that affects the engineering industry. Send your letters to the Signals and Noise Editor, 275 Washington St, Newton, MA 02158. We welcome all comments, pro or con. All letters must be signed, but we will withhold your name upon request. We reserve the right to edit letters for space and clarity.

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The SigmaSeries is available through most major instrument rental and leasing companies.
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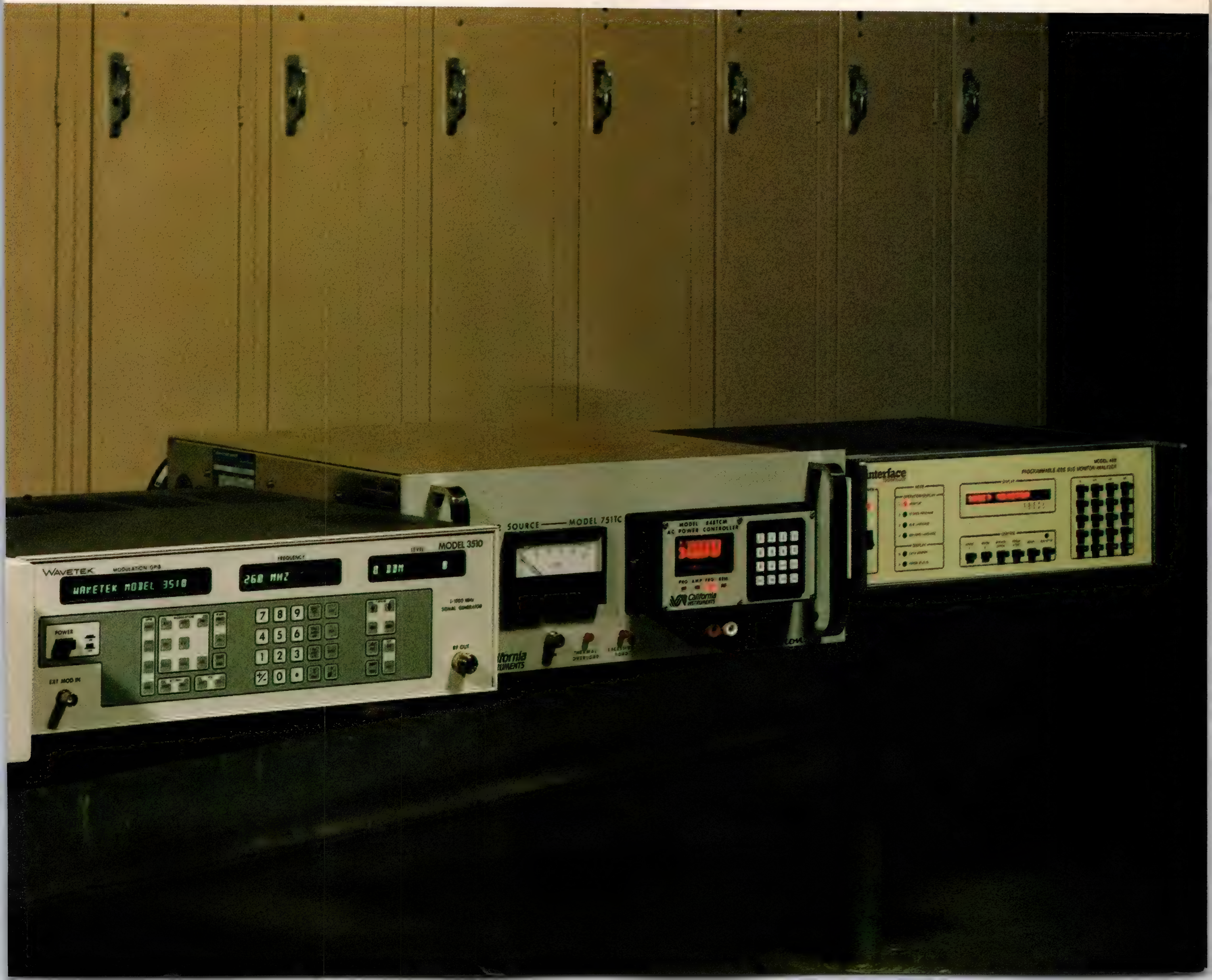
CIRCLE NO 31



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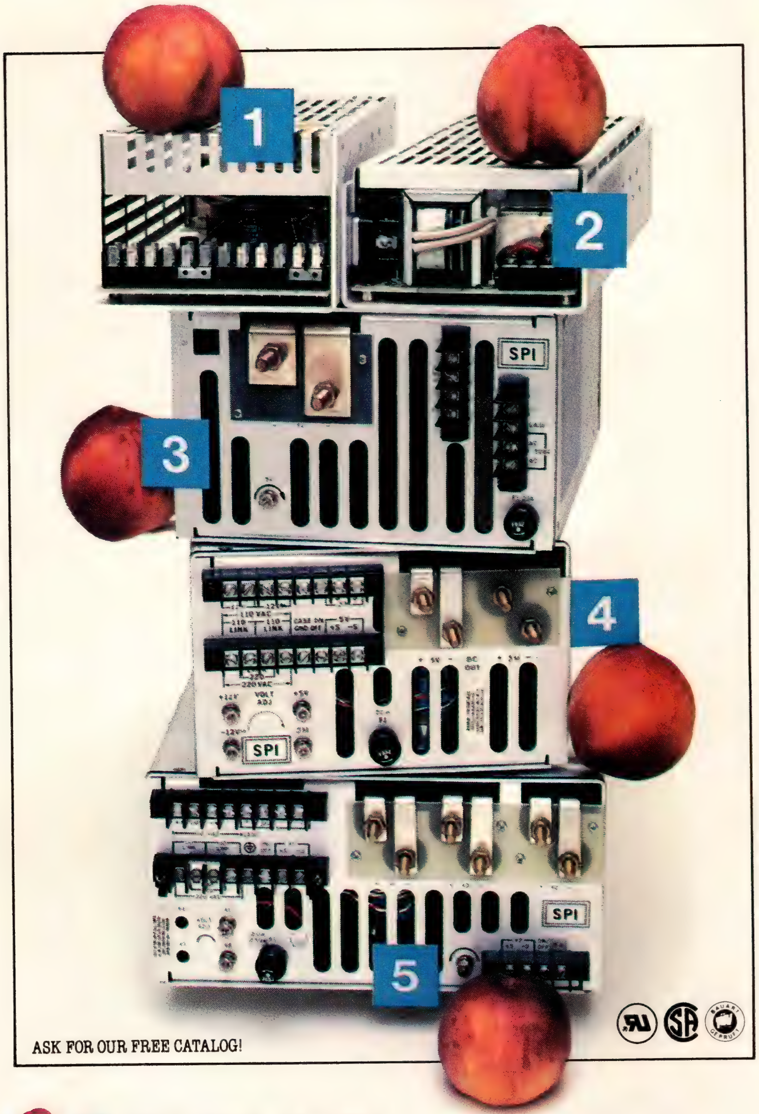

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CIRCLE NO 33

CALENDAR

International Tesla Symposium, Colorado Springs, CO. IEEE Pikes Peak Section, Box 150, Colorado Springs, CO 80901. July 30 to August 3.

SIMS '86 (Symposium for Innovation in Measurement Science), Geneva, NY. Instrument Society of America, 67 Alexander Dr, Research Triangle Park, NC 27709. (919) 549-8411. August 3 to 8.

PC Fab Expo, Boston, MA. PC Fab Expo, 1790 Hembree Rd, Alpharetta, GA 30201. (404) 475-1818. August 11 to 13.

Modern Power Conversion Design Techniques (short course), Seattle, WA. E/J Bloom Associates, 115 Duran Dr, San Rafael, CA 94903. (415) 492-8443. August 11 to 15.

Siggraph '86 (13th Annual Conference on Computer Graphics and Interactive Techniques), Dallas, TX. Smith, Bucklin & Associates, 111 E Wacker Dr, Chicago, IL 60601. (312) 644-6610. August 18 to 22.

3rd International Congress on Advances in Non-Impact Printing Technologies, San Francisco, CA. Society of Photographic Scientists and Engineers, 7003 Kilworth Lane, Springfield, VA 22151. (703) 642-9090. August 24 to 28.

8th Quartz Devices Conference, Kansas City, MO. Electronic Industries Association, Components Group, 2001 Eye St NW, Washington, DC 20006. (202) 457-4930. August 26 to 28.

Advanced Database Symposium, Tokyo, Japan. Information Processing Society of Japan, Kikaishinkou Kaikan, 3-5-8 Shiba Park, Minatoku, Tokyo 105, Japan. August 29 to 30.

World Computer Congress, International Federation for Information Processing (IFIP '86), Dublin,

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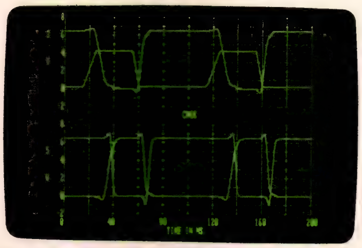
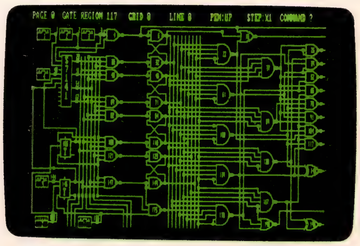

"Typical MICROCAP Transient Analysis"


"Typical MICROLOGIC Diagram"

How many long unproductive hours have you spent "in line" for your simulation? Well, no more. MICROCAP and MICROLOGIC can put you on line by turning your PC into a productive and cost-effective engineering workstation.

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MICROCAP: Your Analog Solution

MICROCAP is an interactive analog circuit drawing and simulation system. It allows you to sketch a circuit diagram right on the CRT screen, then run an AC, DC, or Transient analysis. While providing you with libraries for defined models of bipolar and MOS devices, Opamps, transformers, diodes, and much more, MICROCAP also includes features not even found in SPICE.

MICROCAP II lets you be even more productive. As an advanced version, it employs sparse matrix techniques for faster simulation speed and larger networks. In addition, you get even more advanced device models, worst case capabilities, temperature stepping, Fourier analysis, and macro capability.

MICROLOGIC: Your Digital Solution

MICROLOGIC provides you with a similar interactive drawing and analysis environment for digital work. Using standard PC hardware, you can create logic diagrams of up to 9 pages with each containing up to 200 gates. The system automatically creates the netlist required for a timing simulation and will handle networks of up to 1800 gates. It provides you with libraries for 36 user-defined basic gate types, 36 data channels of 256 bits each, 10 user-defined clock waveforms, and up to 50 macros in each network. MICROLOGIC produces high-resolution timing diagrams showing selected waveforms and associated delays, glitches, and spikes—just like the real thing.

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Regarding MICROCAP . . . "A highly recommended analog design program" (PC Tech Journal 3/84). "A valuable tool for circuit designers" (Personal Software Magazine 11/83).

Regarding MICROLOGIC . . . "An efficient design system that does what it is supposed to do at a reasonable price" (Byte 4/84).

MICROCAP and MICROLOGIC are available for the Apple II (64k), IBM PC (128k), and HP-150 computers and priced at $475 and $450 respectively. Demo versions are available for $75.

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CIRCLE NO 34

CALENDAR

Ireland. David Hyatt, Data Decisions, 20 Brace Rd, Cherry Hill, NJ 08034. (609) 429-7100. September 1 to 5.

Comdex/Australia, Sydney, Australia. Interface Group, 300 First Avenue, Needham, MA 02194. (617) 449-6600. September 2 to 5.

IEEE Eascon '86 (IEEE Electronics and Aerospace Systems Conference), Washington, DC. Eascon '86, Suite 300, 655 15th St NW, Washington, DC 20005. September 8 to 10.

NCC-Telecommunications Conference, Philadelphia, PA. AFIPS, 1899 Preston White Dr, Reston, VA 22091. (703) 620-8900. September 8 to 10.

Midcon, Dallas, TX. Electronic Conventions Management, 8110 Airport Blvd, Los Angeles, CA 90045. (213) 772-2965. September 9 to 11.

Modern Electronic Packaging, Santa Clara, CA. Technology Seminars, Box 487, Lutherville, MD 21093. (301) 269-4102. September 9 to 11.

International Videotex Industry Exposition and Conference, New York, NY. Videotex Industry Association, 1901 N Fort Myer Dr, Suite 200, Rosslyn, VA 22209. (703) 522-0883. September 15 to 17.

Printed Wiring Board Assemblies —Processes, Techniques, and Equipment (short course), Milwaukee, WI. Peter Tocups, Center for Continuing Engineering Education, University of Wisconsin-Milwaukee, 929 N 6th St, Milwaukee, WI 53203. (414) 224-3952. September 15 to 17.

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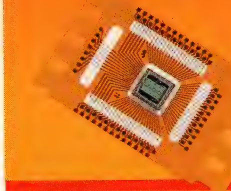

PRODUCT	VOLTAGE	DESCRIPTION
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HV01	60V	16 Channel, 16 Level Gray Shade Push-Pull Output Driver
HV02	250V	16 Channel, High Current Open-Drain Output Driver
HV03 & 05	200 & 300V	64 Channel Serial to Parallel Converter with Open-Drain Outputs
HV04 & 06	40, 60, & 80V	64 Channel Serial to Parallel Converter w/ Push-Pull Outputs
HV10-18	140 & 160V	4 or 8 Channel Bilateral Analog Switch
HV30	180V	7 Segment Decoder w/ Open-Drain Outputs
HV51 & 52	225 & 300V	32 Channel Serial to Parallel Cnvrtr. w/ High Volt. Open-Drain Outputs
HV53 & 54	40, 60, & 80V	32 Channel Serial to Parallel Cnvrtr. w/ High Volt. Push-Pull Outputs

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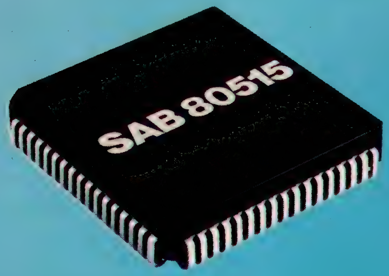
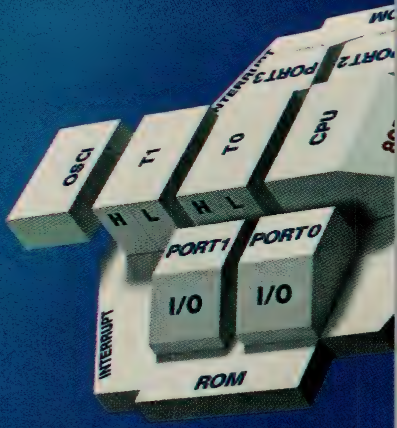
Benefits that make you more competitive, with SAB 80515/535 you're on the market faster with the better product.



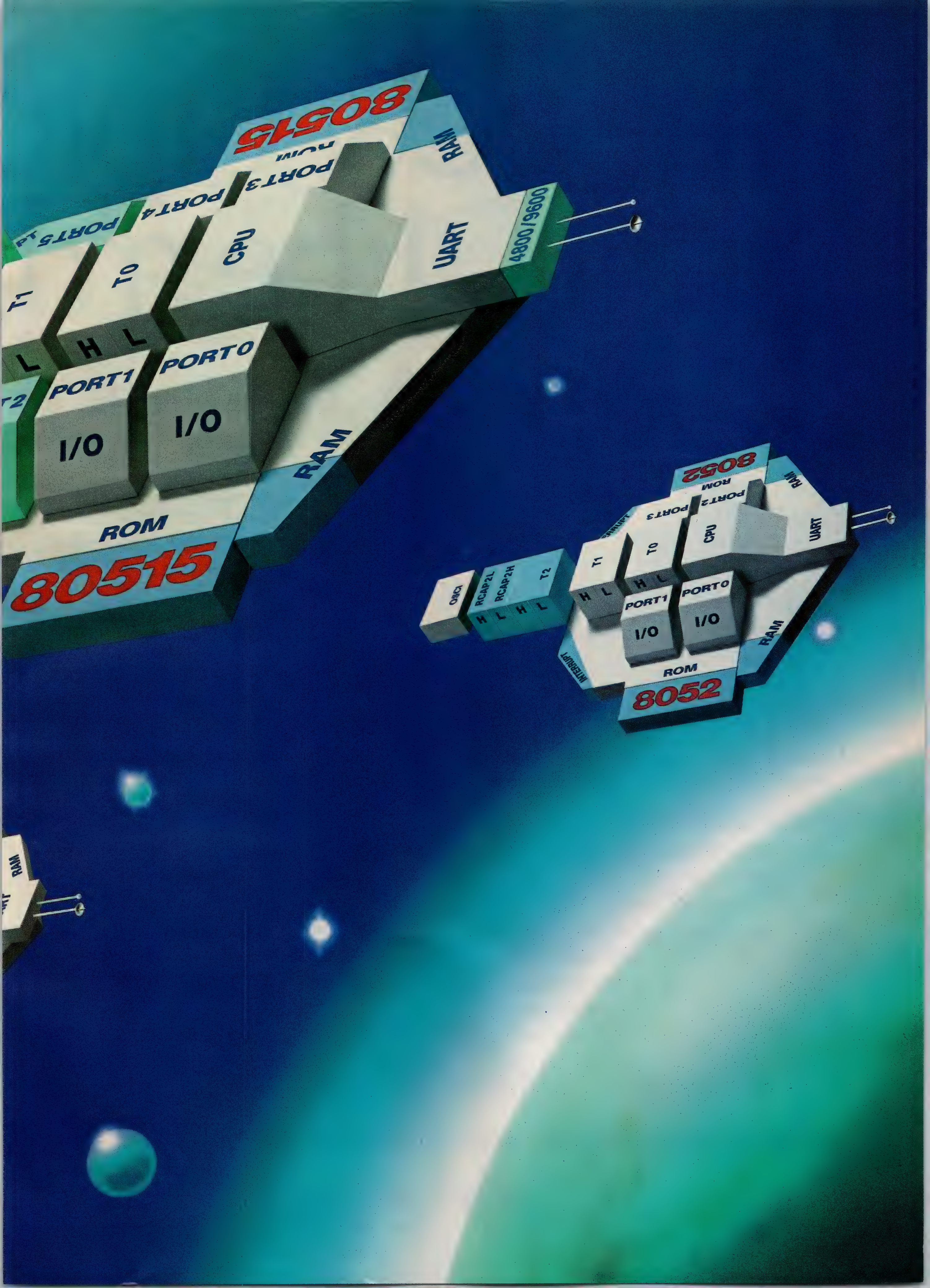


Major features of SAB 80515/535:
All 8051 characteristics with twice the RAM/ROM capacity, hardware/software compatible; 12 interrupt sources/4 priority levels, 6 x 8-bit I/O ports; A/D converter with 8 inputs, S & H, 8-bit resolution; 3 x 16-bit timer/counters; 4 x 16-bit capture/compare/reload functions; watchdog timer; PLCC68 package.

Get the full details. From Siemens AG, Infoservice, Postfach 23 48, D-8510 Fürth, West Germany.

12/Z001.101

CIRCLE NO 9


80515
ROM
PORT3
PORT4
PORT5
RAM
4800/9600
UART
CPU
T0
T1
H
L
PORT1
PORT0
I/O
I/O
RAM
ROM
80515
8052
ROM
PORT2
PORT3
RAM
CPU
UART
T1
T0
H
L
PORT1
PORT0
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I/O
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8052
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T2
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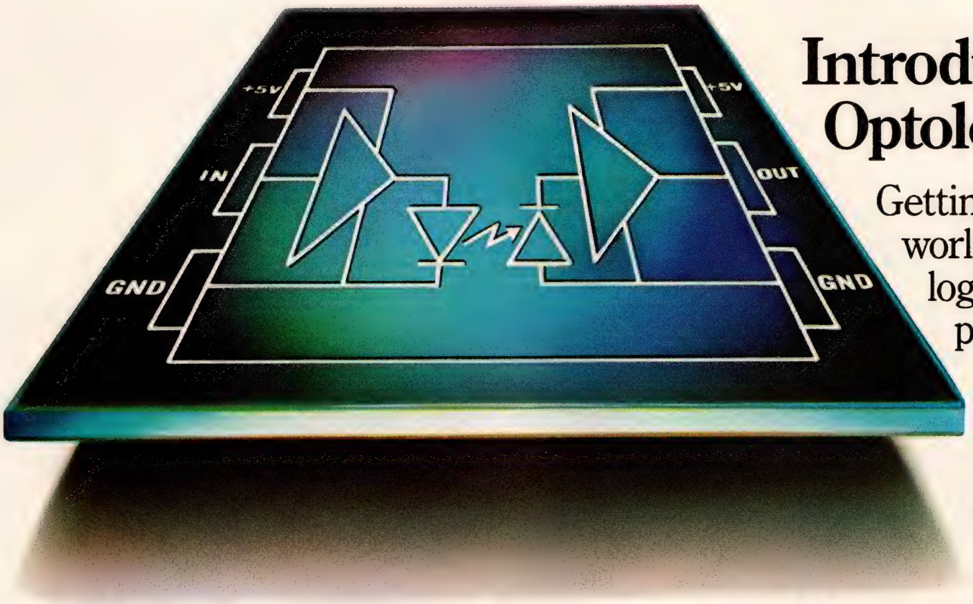

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isolator thinks gital IC.

PART NUMBER	LOGIC COMPATIBILITY		LOGIC FUNCTION	OUTPUT CONFIGURATION
	INPUT	OUTPUT		
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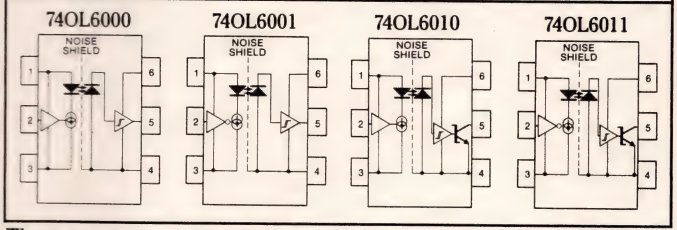
74OL6001	LSTTL	TTL	INVERTER	TOTEM POLE
74OL6010	LSTTL	CMOS	BUFFER	OPEN COLLECTOR
74OL6011	LSTTL	CMOS	INVERTER	OPEN COLLECTOR



There are two output versions available: one with totem pole circuit configuration for TTL compatibility, and another with open collector for interface to 4.5 V to 15 V CMOS or power transistors.

In another common application, AC/DC precision level sensing is possible because of the well-defined input threshold.

And the price is competitive with other high speed optocouplers.

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Propagation delay of the Optologic coupler is 60ns and supports datacom to 15 MBaud. The built-in internal noise shield offers 15kV/μs common mode transient rejection.

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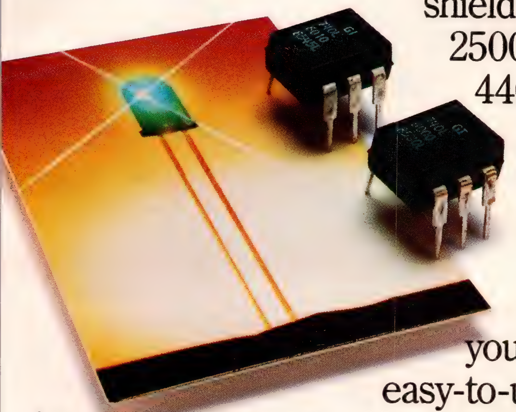

MTTF is 1.68 million hours at 90% confidence.

The Optologic coupler is a fool-proof device that provides a level of design integrity and security that the engineer has not had before.

If you hate leaving the digital world every time you want to optically isolate your circuits, design in the easy-to-use Optologic couplers from the LightHouse. All you do is plug them in.

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CIRCLE NO 38

CANADA

ARROW
CARDINAL INDUSTRIAL ELECTRONICS
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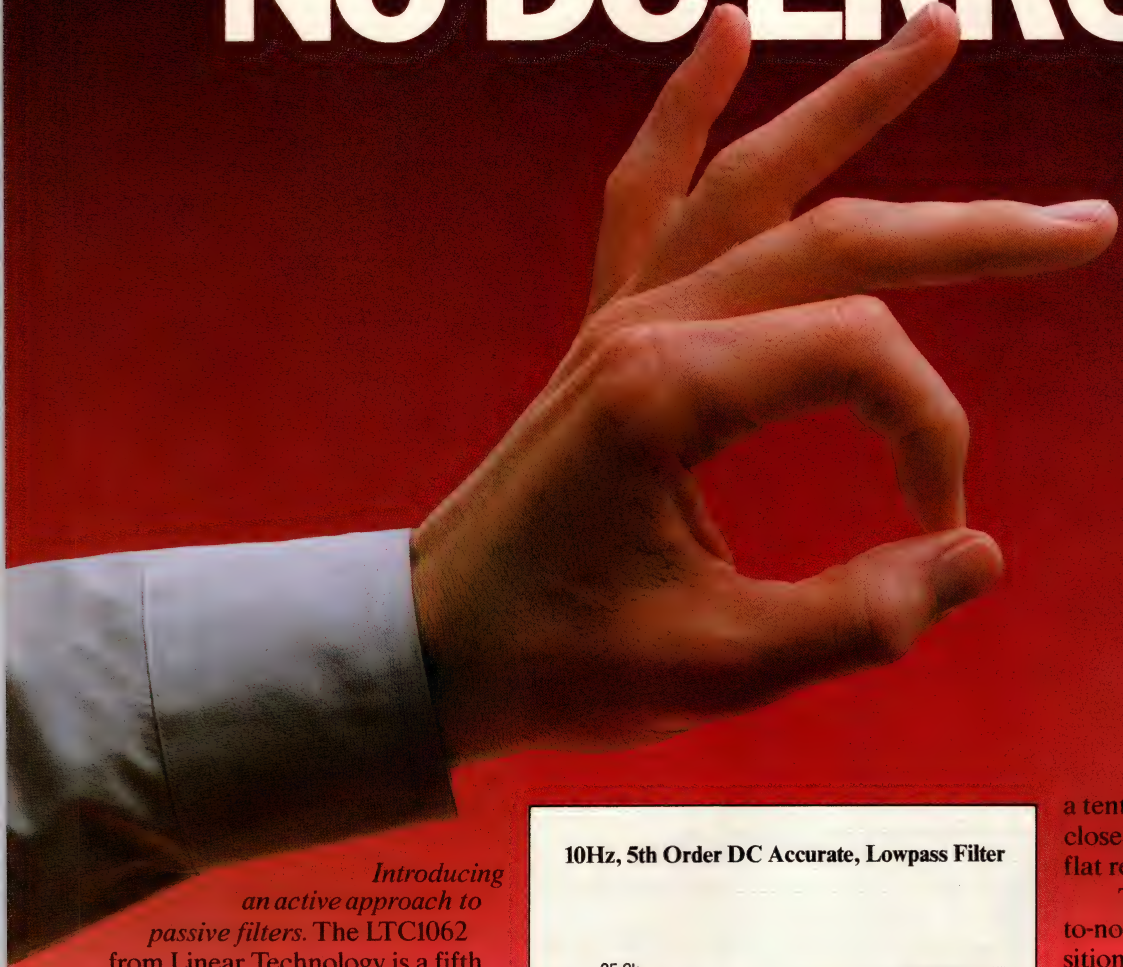
RAE ELECTRONICS

NEW FILTER. NO DC ERROR.



Introducing an active approach to passive filters. The LTC1062 from Linear Technology is a fifth order, all-pole, maximally flat lowpass filter with *no DC error.* The filter's unique architecture puts the active circuitry outside the DC signal path, so DC offset voltage errors and low frequency noise are eliminated.

LTC1062 is a revolutionary new product because it uses an existing, refined switched capacitor technology in a new way. It combines the DC accuracy of a simple resistor-capacitor filter with the filtering performance of a complex network.

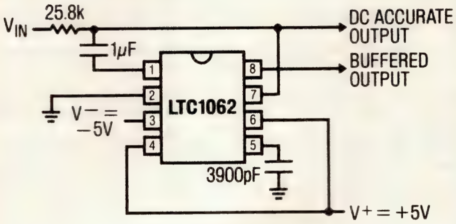
The LTC1062 can make a significant contribution where DC accuracy is important. With the LTC1062, you get low passband noise, −80dB distortion, no aliasing, and fifth order filtering in an economical eight-pin, dual in-line package. Cascading two units forms a tenth order lowpass filter that closely approximates maximally flat response.

The filter's wide (90dB) signal-to-noise ratio is ideal for data acquisition applications demanding low passband noise. The LTC1062's operation at up to 20kHz cutoff frequency makes it a good choice for audio circuits. And it's easy to use because there's no need to know filter synthesis to apply it.

The message is simple. *New filter. No DC error.* And the LTC1062 is just one member of an entire filter family. LTC1059/1060 and 1061 single, dual and triple precision, high-performance universal filters are also available.

In quantities of 100, the commercial version (−40°C to +85°C) of the LTC1062CN8 is $3.55 each. The military version, LTC1062MJ8, is $7.00 each in similar quantities. For technical data sheets, contact: LINEAR TECHNOLOGY CORPORATION, 1630 McCarthy Blvd., Milpitas, CA 95035. (408) 942-0810.

10Hz, 5th Order DC Accurate, Lowpass Filter



- 60μV NOISE IN THE PASSBAND, 100μV WIDEBAND NOISE.
- −80dB TOTAL HARMONIC DISTORTION (THD).
- INPUT R,C ALSO ACTS AS AN ANTI-ALIASING FILTER.

LINEAR TECHNOLOGY

TOUGH PRODUCTS
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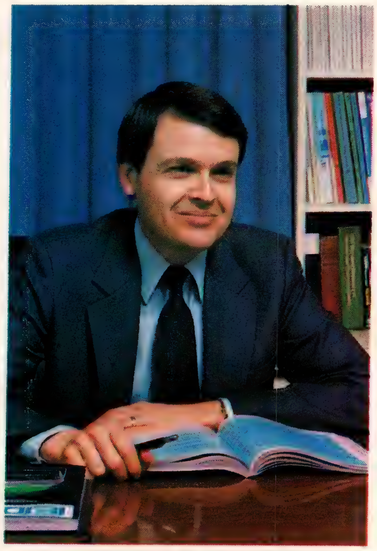
Tell us what you want



One question I'm asked frequently in my role as editor of EDN is, "How do you decide what topics to cover?" That's a fair question, and an easy one, so I'm always glad to answer it. EDN's editors decide what topics to feature according to (a) their own knowledge of electronics engineering, and (b) information gathered from their contacts in the electronics industry, including our 130,000 readers. It's that simple.

Most EDN editors have EE degrees and experience in electronic design. We can't have it any other way if we are going to provide you with the in-depth technical information you need. In addition, our editors are in constant contact with all the leading companies in the industry, scouting out the emerging technologies and innovative product offerings. Nevertheless, we would still fall short of our goal of providing you the most useful and interesting information if we didn't pay attention to our best source of information: the reader. You, the designers and managers who wrestle with technology eight hours a day (and more), know better than anyone what you want and need.

Many of you have responded to surveys that we've conducted in order to find out what's important to you. If you're one of our many readers who have taken the time to fill out a questionnaire, we thank you. We've also received good suggestions from your letters and in comments you've written on our bingo cards. For example, a reader wrote last fall to suggest that we print an updated version of Jim Williams's "Analog IQ Test," which we originally published in 1979. We honored the request and were gratified by the enthusiastic reader response. We especially liked the comment from one reader, a digital designer, who said he enjoyed the test even though he flunked it.

It's easy to offer us suggestions, so we invite you to do so. Just jot a comment on a bingo card and send it in. We can't promise a personal reply to each suggestion (after all, there are 130,000 of you and only 27 of us), but we do read every card we get, and we will consider every serious suggestion. If you don't have a suggestion, send us a card anyway and just say hello. We like to know you're out there; it reminds us we're writing for real people.

Gary Legg

Gary Legg
Editor

Bipolar arrays provide 100-MHz clock rates for designs as large as 10,000 gates

Offering 10,000 available gates and 100-MHz system-clock frequencies, a series of gate arrays combines the high integration levels characteristic of CMOS arrays with the higher clock frequencies associated with bipolar arrays.

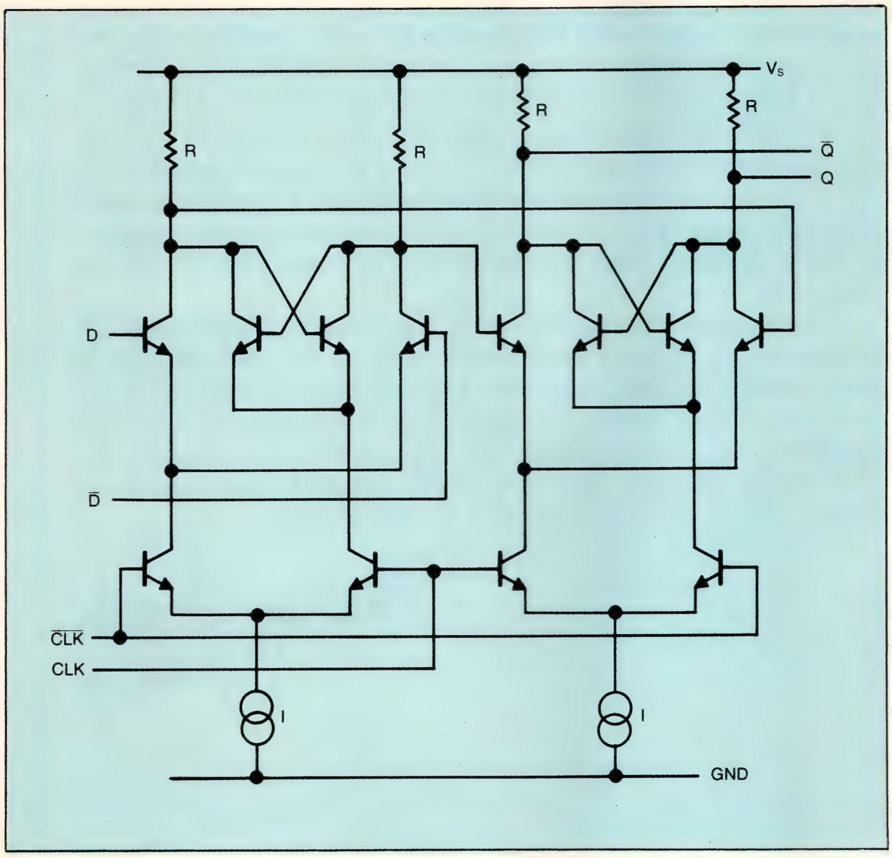
The DS Series arrays have a 1-nsec typ gate delay. Although some CMOS arrays spec the same delay, these bipolar parts can implement higher clock rates than can the CMOS parts, because the propagation delay through the bipolar macros is relatively unaffected by loading, whereas delay in CMOS macros is very dependent on loading.

The DS Series arrays employ differential-logic circuits, which allow flip-flops to dissipate 750 μW typ at toggle frequencies as high as 250 MHz. In comparison, most bipolar arrays dissipate at least 1 mW per gate and use six gates to create a flip-flop.

The low power consumption of the differential-logic macros allows the vendor to integrate 10,000 equivalent 2-input gates on the largest DS array. The other nine arrays in the series range in complexity from 630 to 7920 gates. In comparison, most bipolar gate arrays have fewer than 5000 gates.

The differential logic generates logic states by steering current through differential pairs of transistors. Flip-flops built from this logic exhibit a 1.5-nsec propagation delay, which is only 50% larger than the 1-nsec delay for individual gates. In contrast, most other flip-flops exhibit gate delays equivalent to two or three levels of logic. The lower delay of the DS arrays' differential logic allows the arrays to support 250-MHz toggle frequencies, even when operating from power supplies as low as 2V.

Depending on the array you use, your design can employ between 32 and 138 I/O cells. You can use the I/O cells as high-current bus drivers to sink as much as 48 mA. Although this capability isn't unusual for bipolar arrays, it's two to five times the maximum current that large CMOS arrays offer.



Differential logic implements flip-flops *with clock-to-output propagation delays of 1.5 nsec typ for DS Series gate arrays. This D-type flip-flop consumes 750 μW at 250 MHz, a figure lower than that specified for the gates on most other bipolar arrays.*

Design tools

The vendor supplies design tools and a macro library for Daisy, Mentor, Valid, and DEC VAX workstations. You can perform logic design and simulation on these workstations. If you have a VAX minicomputer, you can purchase tools from the vendor to perform layout and verification as well as logic design and simulation. The macro library contains over 100 macros.

Turnaround time from verified layout is six weeks typ; nonrecurring engineering charges start at $6000. From $2.90 in production quantities.—***David Smith***

Ferranti Interdesign, 1500 Green Hills Rd, Scotts Valley, CA 95066. Phone (408) 438-2900.

Circle No 744

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68000 SDS includes an MS-DOS compatible 68000 ACCELERATOR BOARD that plugs into one expansion slot, two assemblers, linker, utilities and run time libraries, your choice of optimizing C or Pascal compilers, floating point support, a symbolic debugger, and an in-circuit emulator.

LANGUAGE RESOURCES concentrates on development tools and systems for the Motorola 68000-68010-68020 microprocessors. The LANGUAGE RESOURCES development tools are also available on IBM and VAX mainframes. When you have a project that requires quality work, ask LANGUAGE RESOURCES about their quality tools.

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CIRCLE NO 40

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section keeps you informed
of current job openings
from coast-to-coast

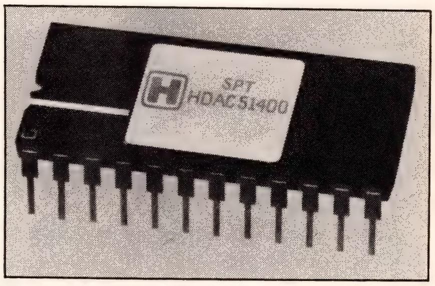
TURN TO
PAGE 266

Raster-scan 400-MHz video D/A converter accommodates 2k×2k screen resolution

Designed for high-speed, raster-scan graphic video-display applications, the HDAC51400 8-bit D/A converter offers 400-MHz typ (385-MHz min) conversion throughput. This conversion rate, which the manufacturer claims is the fastest rate available from any D/A converter on the market, makes the converter capable of driving displays having resolutions as high as 2k×2k pixels.

The RS-343A-compatible converter has the full complement of video controls: Sync, Blank, 10% Overbright, and Force High. An ECL-compatible (10KH and 100K) register accepts the video data and controls. The differential current outputs from the output current switches can drive a doubly terminated 50 or 75Ω line to standard composite-video levels (0 to −1071 mV).

A bandgap reference aboard the HDAC51400 is capable of driving the host D/A converter plus two other HDAC51400s in an RGB graphics system. One 5V power supply powers the converter. The standard setup level (the difference between video black and blank) is 7.5 IRE units (53.6 mV); a setup level of 0 IRE units is available as a mask-programmed option.

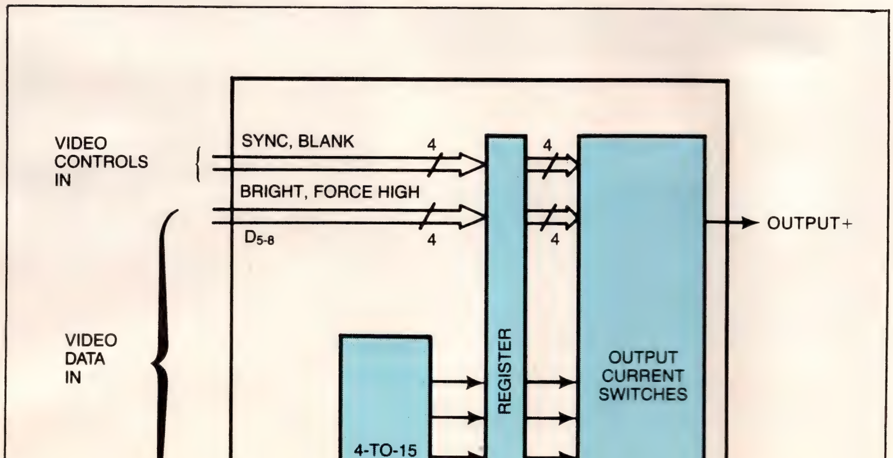


Suitable for high-resolution CAD/CAE workstations, *the HDAC51400 video D/A converter from Honeywell Signal Processing Technologies accommodates screen resolutions as high as 2k×2k pixels. Shown here in a side-brazed DIP, the device is also available in a ceramic DIP or a leadless chip carrier.*

You can choose from three packaging options for the HDAC51400: a 24-pin ceramic DIP, a side-brazed ceramic DIP, and a leadless chip carrier. Samples are available now; full production is scheduled for the third quarter of this year. $58.31 (1000).—***Bill Travis***

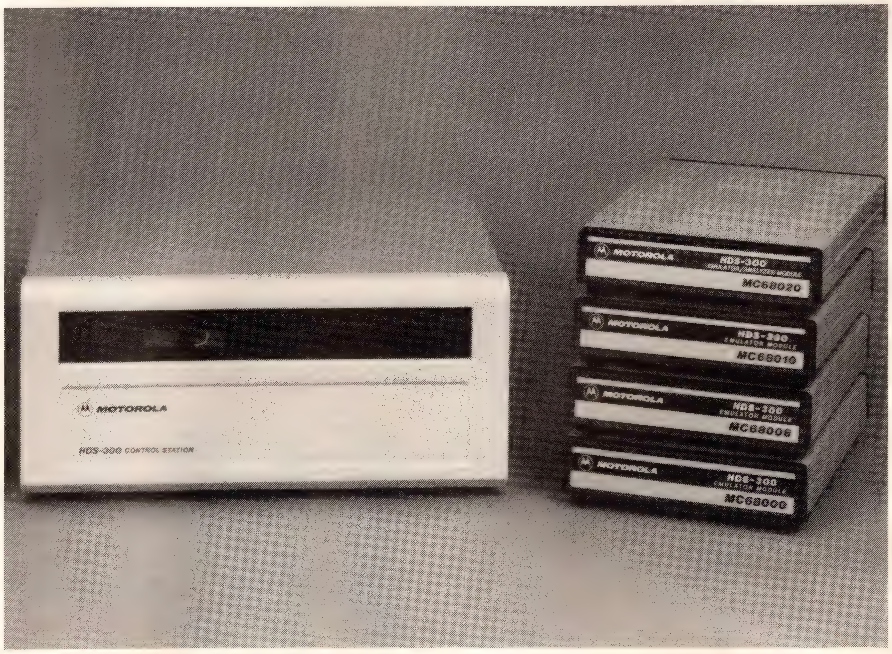
Honeywell Inc, Signal Processing Technologies, 1150 E Cheyenne Mountain Blvd, Colorado Springs, CO 80906. Phone (303) 577-3511.

Circle No 745



Capable of driving high-resolution displays, *the HDAC51400 8-bit video D/A converter provides throughput as high as 400 MHz. The ECL-compatible converter derives its power from one 5V power supply. A complete set of video controls makes the converter compatible with the RS-343A video standard; all video controls and screen data go into a register to await a convert command.*

In-circuit emulators for 68000 µPs offer real-time speeds, no wait states


MOTOROLA
HDS-300 CONTROL STATION
MOTOROLA HDS-300 EMULATOR/ANALYZER MODULE MC68020
MOTOROLA HDS-300 EMULATOR MODULE MC68010
MOTOROLA HDS-300 EMULATOR MODULE MC68008
MOTOROLA HDS-300 EMULATOR MODULE MC68000

Emulator modules for the 68000, 68008, 68010, and 68020 µPs (right) *from Motorola support real-time in-circuit emulation on the company's HDS-300 development station (left).*

You can achieve real-time in-circuit emulation in your 68000, 68008, 68010, and 68020 µP-based systems with the six 68000-family emulator modules for the vendor's $7195 HDS-300 development station. The M68000HM3, M68008HM3, and M68010HM3 modules perform in-circuit emulation for the 68000, 68008, and 68010, respectively. The M68020HM3-1, -2, and -3 emulators, all for the 68020, differ in the amount of onboard emulation RAM they include: They have 64k bytes, 256k bytes, and 1M byte of RAM, respectively.

The emulators for the 68000, 68008, and 68010 support zero-wait-state emulation at 10-MHz µP clock rates. The 68020 emulators support zero-wait-state emulation to 16 MHz; they can operate at 20 MHz with one wait state.

The 68000, 68008, and 68010 emulators have 63-bit wide, 1k-word trace buffers that make eight bits available as general-purpose target probes. The internal bus analyzer uses trace buffers to record events during emulation. The vendor calls this analyzer a bus-state monitor (BSM). You can program the BSM to record bus cycles continuously during emulation until you stop it either manually or via a preset breakpoint in your program. You can also program a trigger to start the BSM when a particular event occurs.

The BSM also performs software-performance analysis. It displays a histogram of the time spent on emulation in 16 address spaces, so you can determine which portions of your program require the most execution time. You can use this information to concentrate your programming efforts on speeding the program portions that use the greatest µP bandwidth.

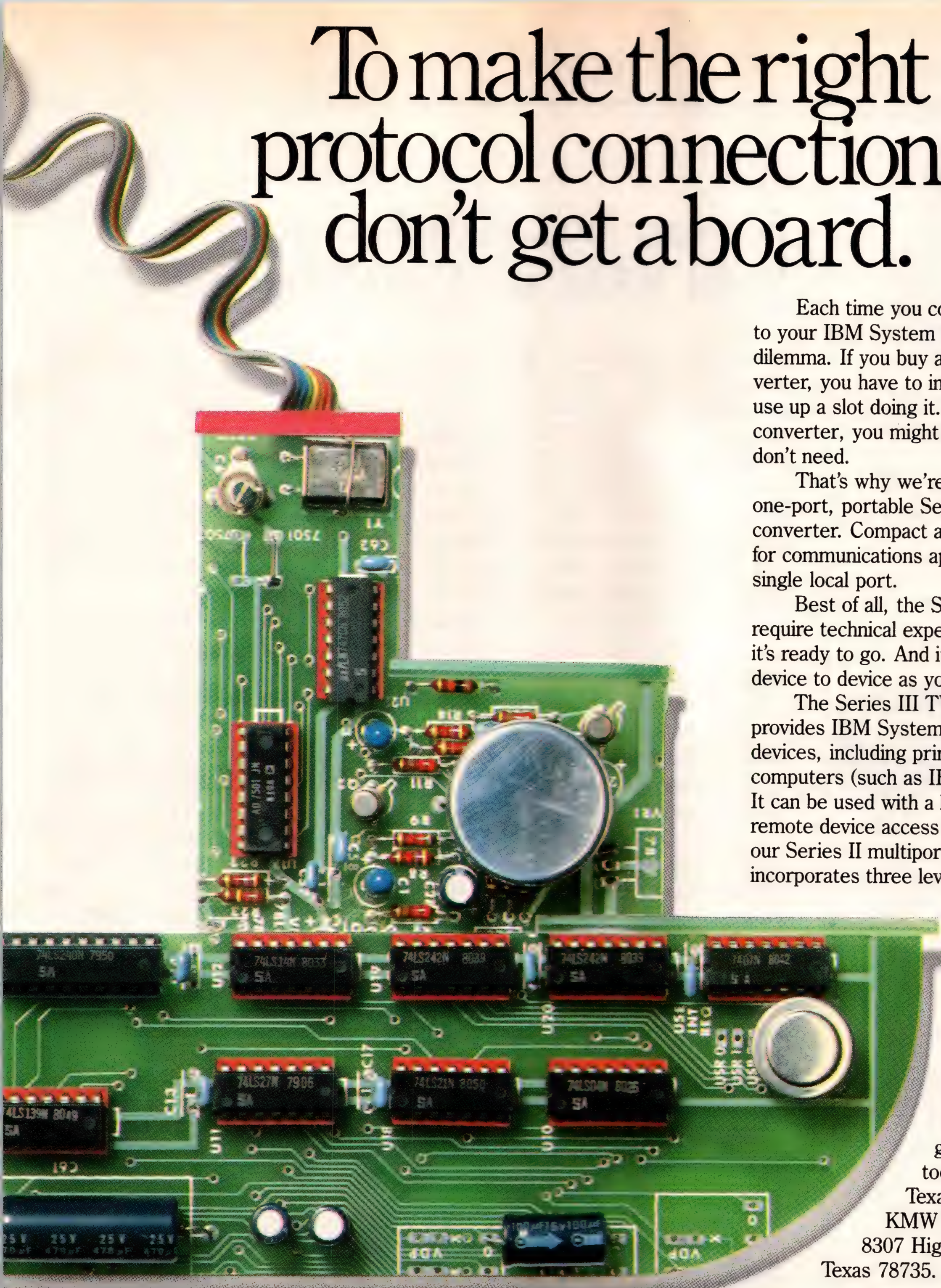
Emulators for the 68020 don't have an integrated trace buffer. Instead, you must add the optional system-performance analyzer (SPA) The SPA has a 144-bit wide, 4k-word trace buffer. The word is divided into a 112-bit field for address, data, and control signals, as well as eight target-probe signals. The SPA also offers a 32-bit field for use as a time tag.

You can allocate the entire 4k-word trace buffer to the capture of a single event, or you can divide the buffer into as many as 16 trace blocks with individual trigger definitions. The SPA also supports three hardware breakpoints. The M68000HM3 and M68008HM3 each cost $3300; the M68010HM3 sells for $4400. The M68020HM3-1, -2, and -3 cost $6500, $11,400, and $16,300, respectively. The M68HDS3SPA sells for $4500.—***Steven H Leibson***

Motorola Inc, Microprocessor Products Group, Box 2953, Phoenix, AZ 85062. Phone (602) 438-3501.

Circle No 742

To make the right protocol connections, don't get a board.



Each time you connect a PC or peripheral to your IBM System 34, 36 or 38, you face a dilemma. If you buy a board level protocol converter, you have to install it yourself — and use up a slot doing it. If you buy a multiport converter, you might be paying for ports you don't need.

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The Series III TWINAX converter provides IBM System 3X connections for most devices, including printers, CRT's and microcomputers (such as IBM, Wang and Macintosh). It can be used with a low cost modem to give a remote device access to the 3X as well. And like our Series II multiport TWINAX converter, it incorporates three levels of internal diagnostics, menu-driven programmability, printer passthrough, file transfer and 25th status line capabilities.

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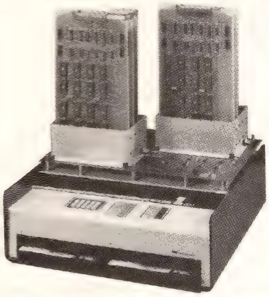
CIRCLE NO 42

AMERICA'S BEST PROGRAMMERS



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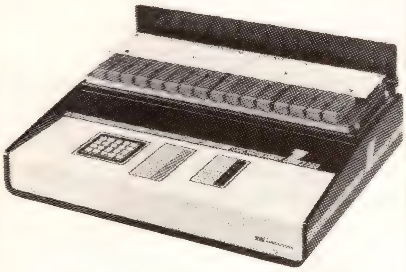

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CIRCLE NO 43

5¼-in. ESDI disk drives hold 85M to 170M bytes

The 6085E, 6128E, and 6170E full-height, 5¼-in. ESDI Winchester disk drives have respective capacities of 85.3M, 128M, and 170.6M bytes (unformatted). All the drives in the 6000E series feature run-length-limited 2/7 data encoding, automatic head retraction and locking during power down, sputtered media, and linear voice-coil actuators with a closed-loop, full-surface servo system. All models support a 10M-bps data-transfer rate, hard or soft sectoring, and serial ESDI operation with several optional commands. The drives dissipate 28W max during operation and 17W in standby mode.

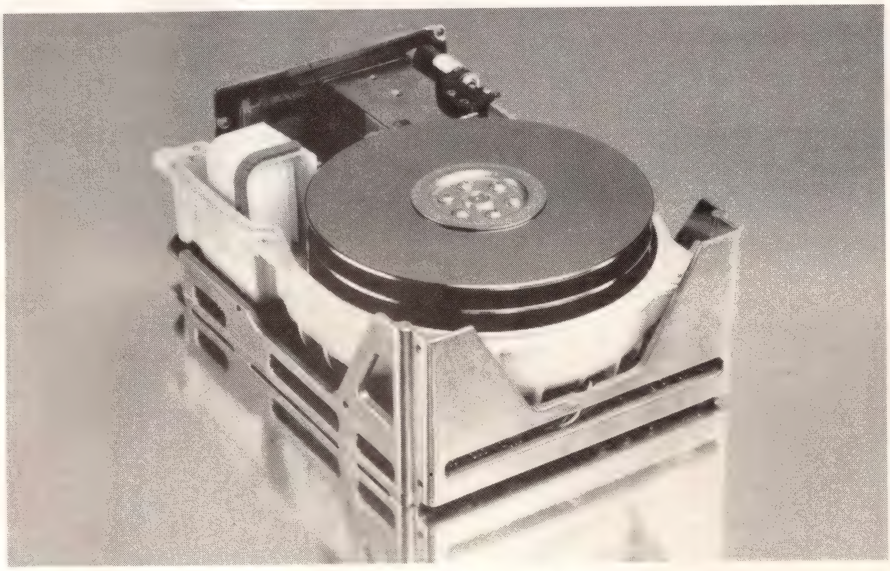
Among the optional ESDI commands that the drives support are spindle start and stop and vendor-code messages. These vendor-code messages provide a controller with access to a drive's model number, storage capacity, manufacturer's vendor code, and a vendor-unique extended drive status.

You can position a jumper on the drive to prevent the spindle motor from starting until the drive receives a start-spindle command. This feature is useful for starting drives sequentially in systems whose power-supply capacity is sufficient to power all drives in a system, but insufficient to supply the greater current needed to start the drives simultaneously.

All three drives support hard-sectored track formats with 162- to 4096-byte sectors. An ESDI command sets the hard-sector size before formatting. Variable-size counters read pulses from the servo track to determine sector size. The variable-size counters allow the drives to support track restructuring within the hard-sector format. The 6085E, 6128E, and 6170E cost $1000, $1150, and $1300 (2500) respectively.—***Steven H Leibson***

Miniscribe, 1861 Lefthand Circle, Longmont, CO 80501. Phone (303) 651-6000.

Circle No 741



Supporting 10M-bps data rates and capacities to 170M bytes, *the 6000E series of 5¼-in. ESDI Winchester disk drives offer hard or soft sectoring and serial ESDI operation with several optional commands.*

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CIRCLE NO 44

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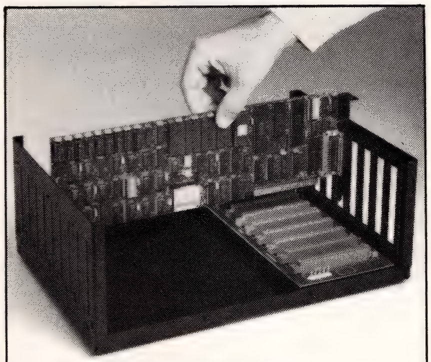

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CIRCLE NO 45

PC spreadsheet software performs signal analysis

A software package that provides post-acquisition data analysis in a spreadsheet format runs on IBM PCs and compatibles. Unlike conventional business spreadsheets, DADISP II isn't limited to basic math formulas. The program also supports complex engineering functions such as trigonometric, logarithmic, calculus, and statistical functions. In addition, the program can generate trigonometric and hyperbolic waveforms for display and manipulation by other windows in the spreadsheet.

The program can display as many as 64 waveform windows at a time, and you can enlarge and overlay any of the windows. Each window can display an acquired signal or a generated waveform, or it can be associated with a formula.

You can display a previously acquired signal in one window and set up a sequence of transformations or formulas in other windows. For example, to find the convolution of an acquired signal with a sine wave, you'd load the acquired signal into one window, generate a sine wave in a second window by using the GSIN function, and enter the CONV(W1,W2) formula in a third window. Any change you introduce in the two independent waveforms will propagate through to the dependent waveform in the third window.

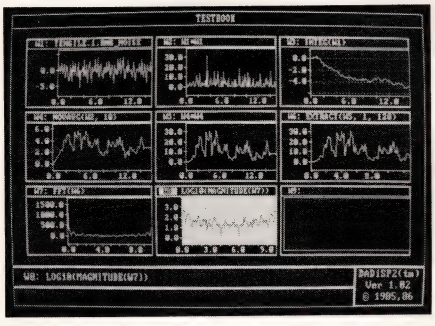
DADISP II's import utility allows you to transfer any ASCII or binary file of raw acquired data into the program's database. You can save the spreadsheet and its setup parameters to disk, and you can set up a command file that can run the acquisition and analysis programs autonomously.

The DADISP II software package costs $795 and runs on an IBM PC/XT, PC/AT, or compatible computer with a minimum of 512k bytes of RAM; a color monitor; and a color graphics adapter, enhanced graphics adapter, or Hercules graphics card. The manufacturer also offers DADISP I ($995), a data-acquisition module for the Keithley 500 series of data-acquisition hardware.

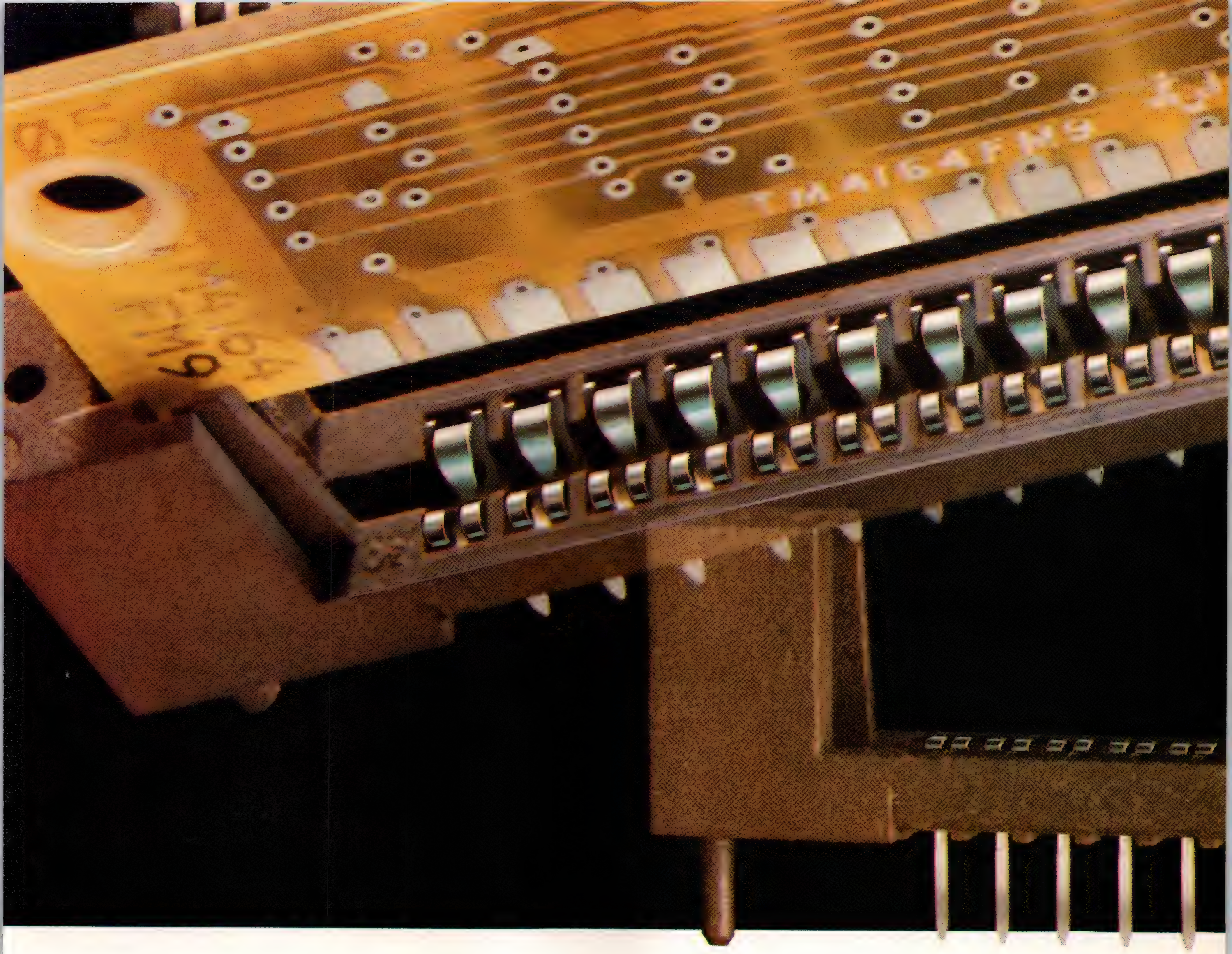
—***Margery S Conner***

DSP Systems, 1 Kendall Square, Building 200, Cambridge, MA 02139. Phone (617) 577-1133.

Circle No 743



You can display as many as 64 windows at once *with the DADISP II engineering spreadsheet. Any of the windows can be enlarged and overlaid. You can display a previously acquired signal in one window and set up a sequence of transformations or formulas in other windows. Any change to an independent window will ripple through the dependent windows.*



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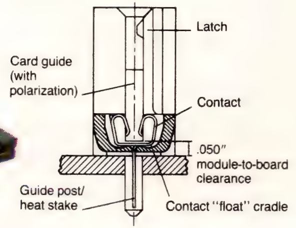
Standard sockets in 10 through 42 positions and low-profile sockets in 30 and 34 positions are available. Angled sockets to address tight board-to-board space applications to be available shortly. SIMM sockets accommodate standard 64K, 256K, and proposed 1M modules.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CIRCLE NO 194

EDN REPRINTS

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CMOS ICs
As featured in EDN Magazine
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A Designer's Guide to CMOS ICs

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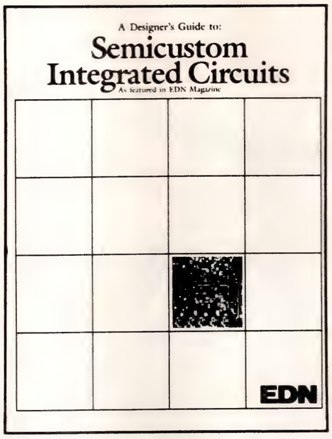

A Designer's Guide to:
Semicustom Integrated Circuits
As featured in EDN Magazine
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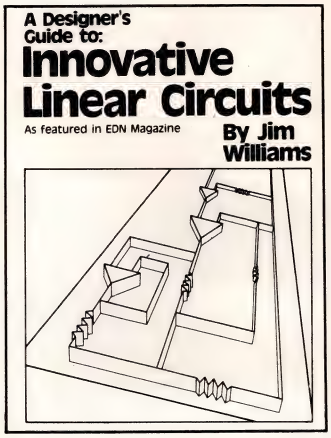
A Designer's Guide to Semicustom Integrated Circuits

Learn how to design a semicustom IC with *A Designer's Guide to Semicustom Integrated Circuits.* Based on EDN's own design experience, this nine-chapter booklet outlines the complete procedure used to design, fabricate, and test EDN 1, a chip with a 1200 equivalent-gate complexity. You'll not only learn the steps to take when creating ICs, but also the design/cost analyses and vendor-interface methods that lead to successful semicustom chips.



A Designer's Guide to:
Innovative Linear Circuits
As featured in EDN Magazine
By Jim Williams

A Designer's Guide to Innovative Linear Circuits

As exciting as digital technology is, you still need analog circuitry to operate on signals from real-world sources. Now, EDN is offering a wealth of analog design information in *A Designer's Guide to Innovative Linear Circuits.* This 186-page collection of articles was developed by Jim Williams, one of America's foremost linear-circuit designers. It includes practical and efficient ways to use op amps, comparators, data converters, and other analog ICs, and discusses the theories behind all the design techniques presented.

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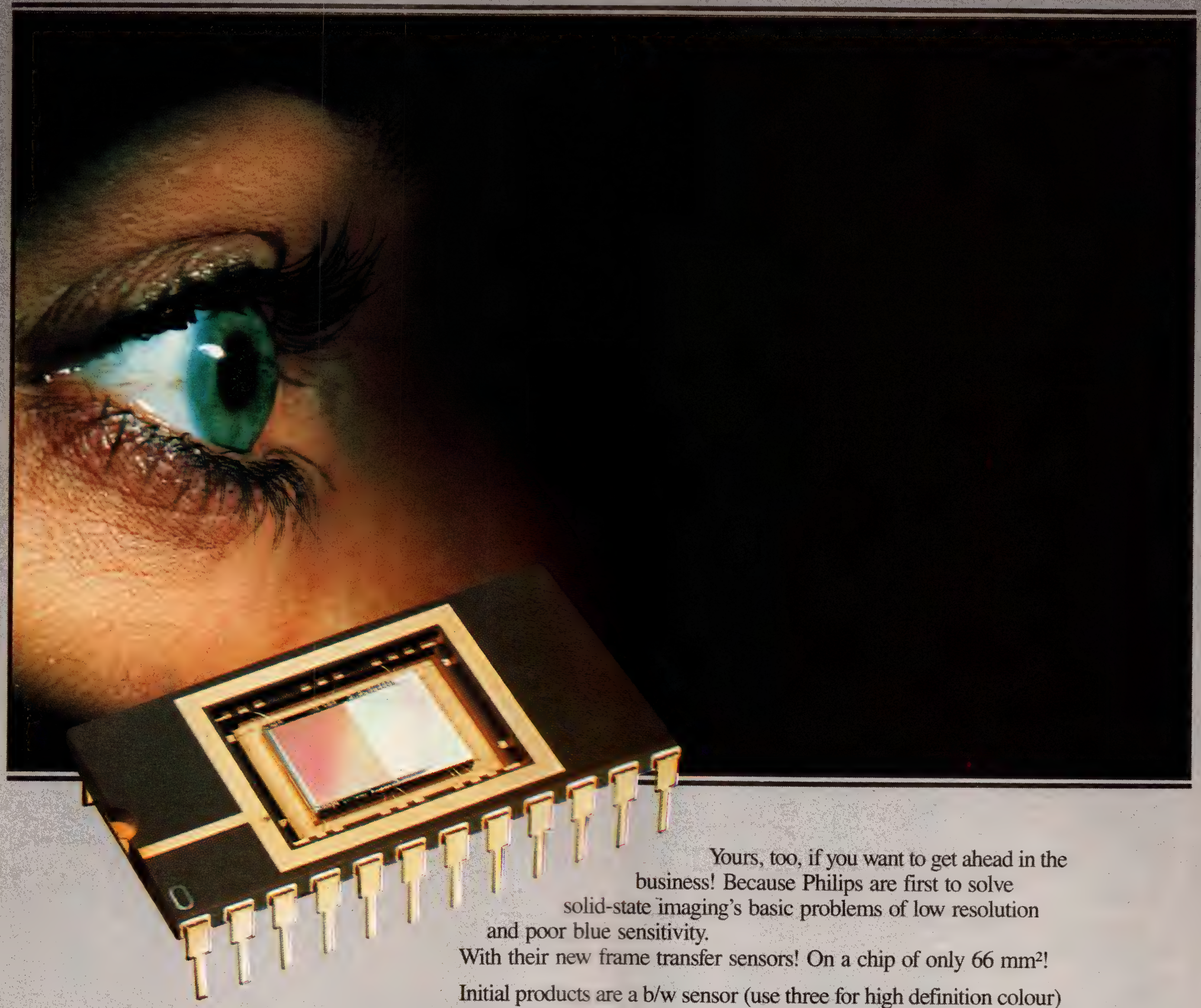

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PHILIPS

Electronic
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CIRCLE NO 46

PHILIPS

LEADTIME INDEX

Percentage of respondents

ITEM	Off the shelf	1-5 weeks	6-10 weeks	11-20 weeks	21-30 weeks	Over 30 weeks	Average (weeks)	Last month's average (weeks)
TRANSFORMERS								
Toroidal	0	50	13	37	0	0	8.0	7.9
Pot-Core	0	20	40	40	0	0	10.0	8.5
Laminate (power)	0	25	50	25	0	0	8.5	8.5
CONNECTORS								
Military panel	0	0	100	0	0	0	8.0	12.0
Flat/Cable	12	50	25	13	0	0	5.0	4.0
Multipin circular	0	33	33	34	0	0	8.7	8.0
PC	0	50	38	12	0	0	6.0	5.8
RF/Coaxial	0	25	25	50	0	0	10.5	7.1
Socket	11	34	33	22	0	0	6.9	3.4
Terminal blocks	11	56	22	11	0	0	4.7	6.1
Edge card	0	29	57	14	0	0	7.4	5.1
Subminiature	0	60	20	20	0	0	6.0	4.5
Rack & panel	0	0	50	50	0	0	12.0	6.0
Power	0	20	60	20	0	0	8.4	3.8
PRINTED CIRCUIT BOARDS								
Single-sided	0	70	30	0	0	0	3.8	3.7
Double-sided	0	7	10	83	0	0	14.2	5.4
Multilayer	0	30	60	10	0	0	7.0	7.0
Prototype	0	93	7	0	0	0	2.4	2.7
RESISTORS								
Carbon film	43	14	36	7	0	0	4.3	2.8
Carbon composition	31	23	23	23	0	0	6.0	4.4
Metal film	29	18	47	6	0	0	5.1	3.1
Metal oxide	17	17	50	16	0	0	7.0	5.2
Wirewound	20	20	40	20	0	0	6.8	5.8
Potentiometers	6	19	50	25	0	0	8.4	4.8
Networks	14	36	29	21	0	0	6.4	4.5
FUSES	25	42	33	0	0	0	3.5	3.3
SWITCHES								
Pushbutton	14	29	43	14	0	0	6.3	4.3
Rotary	13	12	50	25	0	0	8.3	4.7
Rocker	0	17	67	16	0	0	8.3	4.0
Thumbwheel	0	20	60	20	0	0	8.4	4.9
Snap action	0	25	50	25	0	0	8.5	5.2
Momentary	17	33	33	17	0	0	6.0	5.6
Dual in-line	0	25	50	25	0	0	8.5	5.7
WIRE AND CABLE								
Coaxial	14	43	43	0	0	0	4.3	2.5
Flat ribbon	18	64	18	0	0	0	2.7	2.6
Multiconductor	18	46	27	9	0	0	4.5	5.3
Hookup	47	40	13	0	0	0	1.9	1.3
Wire wrap	22	56	22	0	0	0	2.9	2.4
Power cords	7	40	47	6	0	0	5.6	4.7
Other	40	0	60	0	0	0	4.8	4.7
POWER SUPPLIES								
Switching	0	20	60	20	0	0	8.4	7.5
Linear	0	14	72	14	0	0	8.3	5.9
CIRCUIT BREAKERS	0	17	67	16	0	0	8.3	7.3
HEAT SINKS	17	42	33	8	0	0	4.8	4.4

ITEM	Off the shelf	1-5 weeks	6-10 weeks	11-20 weeks	21-30 weeks	Over 30 weeks	Average (weeks)	Last month's average (weeks)
RELAYS								
General purpose	11	11	56	22	0	0	8.2	5.2
PC board	0	14	43	43	0	0	10.6	8.7
Dry reed	0	34	33	33	0	0	8.7	6.3
Mercury	0	34	33	33	0	0	8.7	3.6
Solid state	0	29	43	28	0	0	8.6	6.8
DISCRETE SEMICONDUCTORS								
Diode	5	42	42	11	0	0	5.9	4.5
Zener	12	35	41	12	0	0	5.9	5.2
Thyristor	10	20	50	20	0	0	7.6	6.7
Small signal transistor	7	46	27	20	0	0	6.3	5.8
FET, MOS	0	28	36	36	0	0	9.3	7.2
Power, bipolar	11	22	56	11	0	0	6.7	5.5
INTEGRATED CIRCUITS, DIGITAL								
CMOS	14	7	43	36	0	0	9.3	6.2
TTL	15	15	39	31	0	0	8.3	5.6
LS	15	8	46	23	8	0	9.5	7.6
INTEGRATED CIRCUITS, LINEAR								
Communication/Circuit	0	0	50	50	0	0	12.0	6.7
OP amplifier	0	18	36	36	10	0	11.4	6.5
Voltage regulator	0	10	60	30	0	0	9.8	5.7
MEMORY CIRCUITS								
RAM 16k	0	13	50	37	0	0	10.3	6.1
RAM 64k	0	11	56	33	0	0	10.0	4.7
RAM 256k	0	13	75	12	0	0	8.3	7.5
ROM/PROM	0	0	63	37	0	0	11.0	5.5
EPROM	0	9	64	27	0	0	9.6	6.7
EEPROM	0	0	86	14	0	0	9.1	6.4
DISPLAYS								
Panel meters	0	20	40	40	0	0	10.0	7.4
Fluorescent	0	0	50	50	0	0	12.0	7.5
Incandescent	0	33	33	34	0	0	8.7	4.7
LED	8	38	31	23	0	0	6.9	4.4
Liquid crystal	0	17	50	33	0	0	9.7	7.6
MICROPROCESSOR ICs								
8-bit	0	13	50	37	0	0	10.3	6.6
16-bit	14	14	57	15	0	0	7.1	5.7
FUNCTION PACKAGES								
Amplifier	0	0	67	33	0	0	10.7	6.0
Converter, analog to digital	0	14	43	43	0	0	10.6	6.8
Converter, digital to analog	0	17	33	50	0	0	11.0	7.5
LINE FILTERS	0	40	60	0	0	0	5.6	6.7
CAPACITORS								
Ceramic	0	43	50	7	0	0	6.0	4.6
Ceramic monolithic	0	40	50	10	0	0	6.4	5.3
Ceramic disc	8	46	31	15	0	0	5.8	4.8
Film	0	36	57	7	0	0	6.4	5.6
Electrolytic	0	33	60	7	0	0	6.5	5.7
Tantalum	7	36	43	7	7	0	7.1	5.1
INDUCTORS	11	33	45	11	0	0	6.0	4.9

Source: *Electronic Purchasing* magazine's survey of buyers

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DIMENSIONS	**1.875" x 5.75" x8"**
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Outputs	*5 V, ±12 V; or 5 V, ±15 V*
Switching frequency	*100 kHz*
Efficiency	*60% minimum*
Ripple/noise	*100 mV peak-to-peak maximum*
Line regulation	*10 mV (22 to 32 V dc)*
Load regulation	*10 mV main (0.5% aux outputs)*
EMI	*Meets MIL-STD-461B*
Environment	*MIL-STD-810C, MIL-S-901C*
Input protection	*MIL-STD-704D*
Operating temperature range	*−55°C to +100°C*
Storage temperature range	*−65°C to +125°C*
MTBF (Ground benign)*	
Standard	*140,000 hours*
ER option	*1,100,000 hours*
MTBF (Air inhabited)*	
Standard	*23,000 hours*
ER option	*160,000 hours*

**MIL-STD-217D (50°C Baseplate)*

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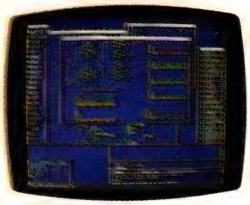

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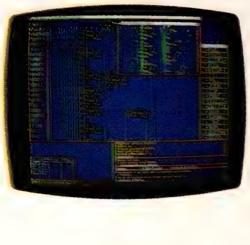

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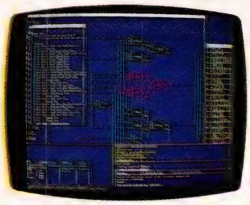

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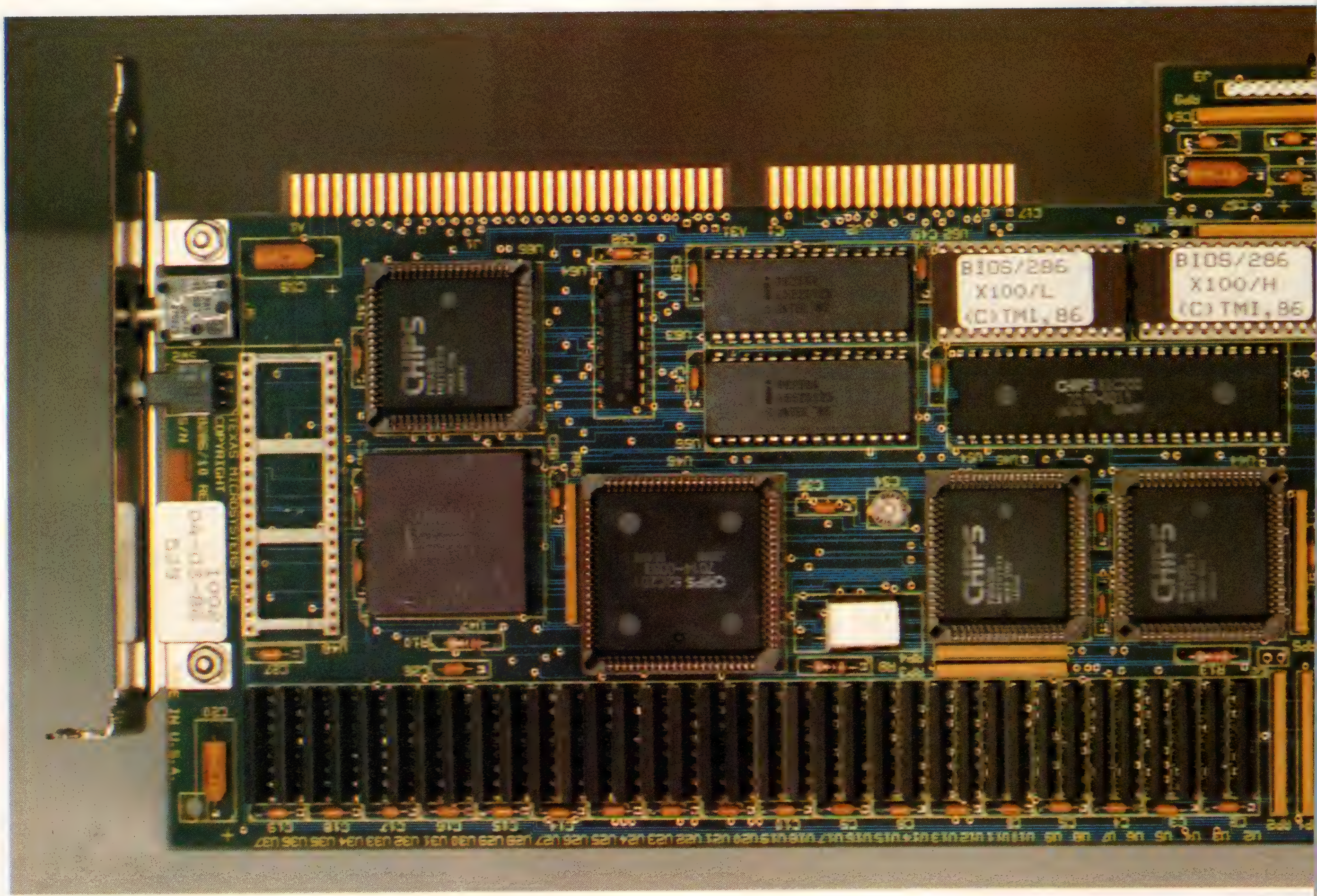
Changing face of electronics

Single-board computers support PC and PC/AT bus

If you want to take advantage of the wealth of software and hardware available for the IBM PC and compatibles, but your intended system is constrained by physical limitations, you should consider using a single-board computer with a PC- or PC/AT-bus passive backplane.

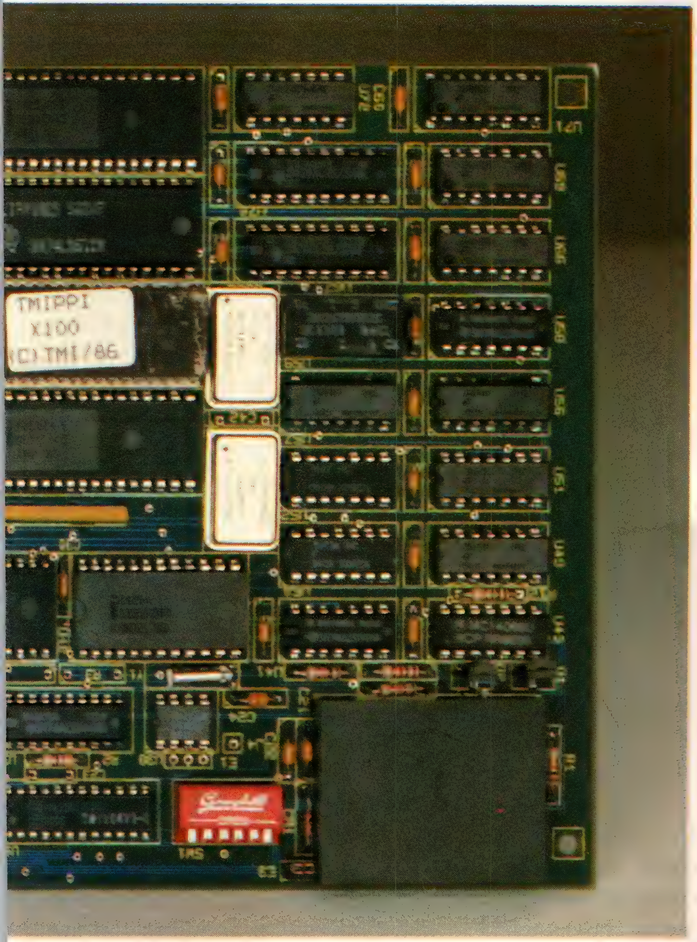
Margery S Conner, *Regional Editor*

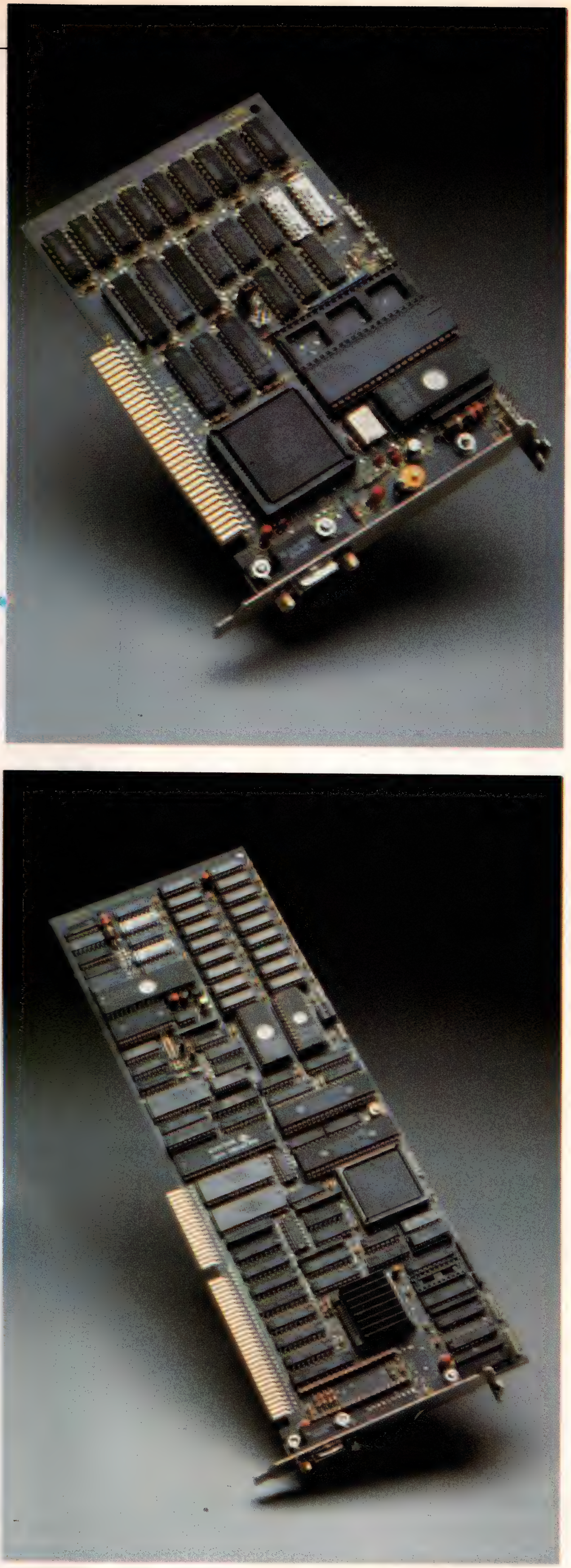
The ready availability of software and add-in boards for the IBM PC make it an attractive choice for your industrial-control and -monitoring applications. Indeed, many companies are reinforcing this trend toward de facto standardization with decrees that their engineers use the PC whenever possible. In many industrial-control environments, however, a PC may be impractical because of size constraints or the need for increased



***80286-based PC/AT single-board computer** (Texas Microsystems Inc)* reliability and easy maintenance. A single-board computer (SBC) in combination with a passive backplane based on the PC or PC/AT bus allows you greater flexiblility in your configuration while maintaining compatibility with the PC.

The size advantage derives principally from the elimination of unnecessary subsystems and circuitry. A typical IBM PC configuration must include a display, a keyboard, and floppy disks, and the PC's mother board must include the appropriate driver and interface cir-





Half-size PC (top) and full-size PC/AT single-board computers *(Faraday Electronics Inc)*

By going with a single-board computer and a passive backplane instead of a fully configured PC, you can achieve a considerable size reduction.

Shrouded CPU board with wall-mounted passive-backplane system *(Action Instruments Inc)*

cuitry to handle these components. In many industrial-control applications, however, the computer you want is embedded in a larger system, and the display and keyboard are not required. Furthermore, such environments are typically too harsh for floppy disks. A passive backplane accepts your SBC, which includes the CPU, RAM, and EPROM, and special-purpose boards, such as data-acquisition cards; you dispense with the circuitry required for unwanted peripherals.

The size reduction can be considerable. A typical PC-based system measures 16×17×6 in., plus the mandatory keyboard and display. A typical 10-slot passive backplane for the PC bus measures 8.3×4.3 in., and an SBC on a full-sized IBM card measures 13.2×4.2 in.

Systems are reliable, easy to maintain

Another contribution to reduced size comes from a lower parts count. Manufacturers of these computers base them on application-specific ICs, which can cut the component count by more than half (see **box,** "ASICs shrink PC and PC/AT systems"). In addition, the lower number of parts and the consequent reduction in potentially problematic interconnect circuitry results in greater reliability.

Another reason for using the PC or PC/AT passive bus instead of a fully configured system is ease of maintenance. Because the IBM PC's CPU circuitry resides on the mother board, you must take the entire system apart in order to treat any malfunctions in the CPU. A system employing a passive backplane and an SBC is a modular one, and repair of a system function can consist of replacing a single board.

Five companies currently offer single-board computers for the PC and PC/AT buses. Because all the products are aimed at the industrial-systems market, many of the board characteristics are similar **(Table 1).** As the market grows and engineers take greater advantage of the ASIC chips on which these boards are based, you can expect to see more variety—chiefly in the form of specialized ports and interfaces.

Direct connections risk damage

In addition to a power supply, a CRT, a keyboard, and a disk drive, a standard IBM PC comes with serial and parallel ports; most PC- and PC/AT-bus SBCs don't have these ports. The B880 from Texas Microsystems, for example, comes with 640k bytes of RAM and a keyboard port. The company is aiming its board line at the industrial user, and it believes that, because the chances of mistakenly applying high voltages are great in industrial settings, the inclusion of direct serial and parallel connections incurs the risk of damage to the computer. The company's boards force you to make all port hookups through an interface board, which, as the company points out, is much cheaper to replace than a CPU board.

For those designers whose systems require ports on the SBC, Faraday's Bus PC card supplies a keyboard port, a parallel port, and two serial ports (RS-232C and jumper-selected RS-232C or RS-422). The board comes with 256k bytes of RAM. For applications in which the size and power requirements are limited, the company offers the half-card Micro PC, which supplies a keyboard port and the same amount of RAM as the Bus PC. (Keep in mind that half-card sizes are not standardized and may differ from manufacturer to manufacturer.) The Micro PC draws 500 mA at 5V. A version using CMOS parts is also available; it requires 150 mA at 5V. Keep in mind, however, that for most applications you will have at least one other board on the

ASICs shrink PC and PC/AT systems

The chip sets that compose the SBCs described in the main text are also available to you directly, so that you can build your own, even more compact SBC in the event your configuration needs aren't served by existing boards. Two companies supply these chip sets, which consist of 8088 and 80286 support circuitry.

Faraday sells the same chip sets used on its PC- and PC/AT-bus boards. The FE3000 supports peripheral-control functions for the 80286, including DMA and bus-control logic and clock generation. It draws 40 mA at 5V and comes in a 68-pin (J-lead) surface-mount plastic chip carrier. The chip costs $45 (100). (See EDN, May 15, 1986, pg 76, for more detail on the Faraday chip set.)

Chips and Technologies Inc sells a 5-chip set, called the CS8220 PC/AT Compatible Chipset, which includes glue logic and peripheral-control logic for 80286-based boards. The two control and decode chips in the set are fabricated in CMOS; one comes in an 84-pin plastic leaded chip carrier (PLCC), the other in a 48-pin DIP. The remaining three chips are bipolar because they must drive circuits that consume lots of power, and they must withstand high ESD levels. These three chips are housed in 68-pin PLCCs. The five chips together draw 800 mA at 5V. The Chipset comes in an 8-MHz version and a 10-MHz version; the respective prices are $61.60 and $68 (100).

The Chipset (**Fig A**) reduces the number of ICs required in a PC/AT board from 130 to 56. The RAM decode circuitry was changed from that of the PC/AT to allow the use of the more common 256k- and 64k-bit RAMs in place of 128k-bit devices. To minimize circuitry, the chip set maintains the PC/AT's established defaults of one wait state for memory accesses and four wait states for I/O; however, you can override these defaults and achieve higher performance with additional circuitry on your board.

You'll need a BIOS for Faraday's and Chips and Technologies' ASICs. Faraday sells its own BIOS versions for the PC and PC/AT for $25 and $35 (100), respectively. Both versions require a $15,000 licensing fee. Chips and Technologies recommends that you use a BIOS from Phoenix Software Associates (Norwood, MA) or Award Software Inc (Los Gatos, CA).

You should be aware that the BIOS for the IBM PC checks for the presence of a keyboard and display at power-on; if they are not present, the boot procedure halts. Because both the Phoenix and Award BIOSs are completely IBM compatible, your system must have a keyboard and display. Because the Faraday BIOS was written specifically for SBC applications, the keyboard and display checks are not included in the BIOS.

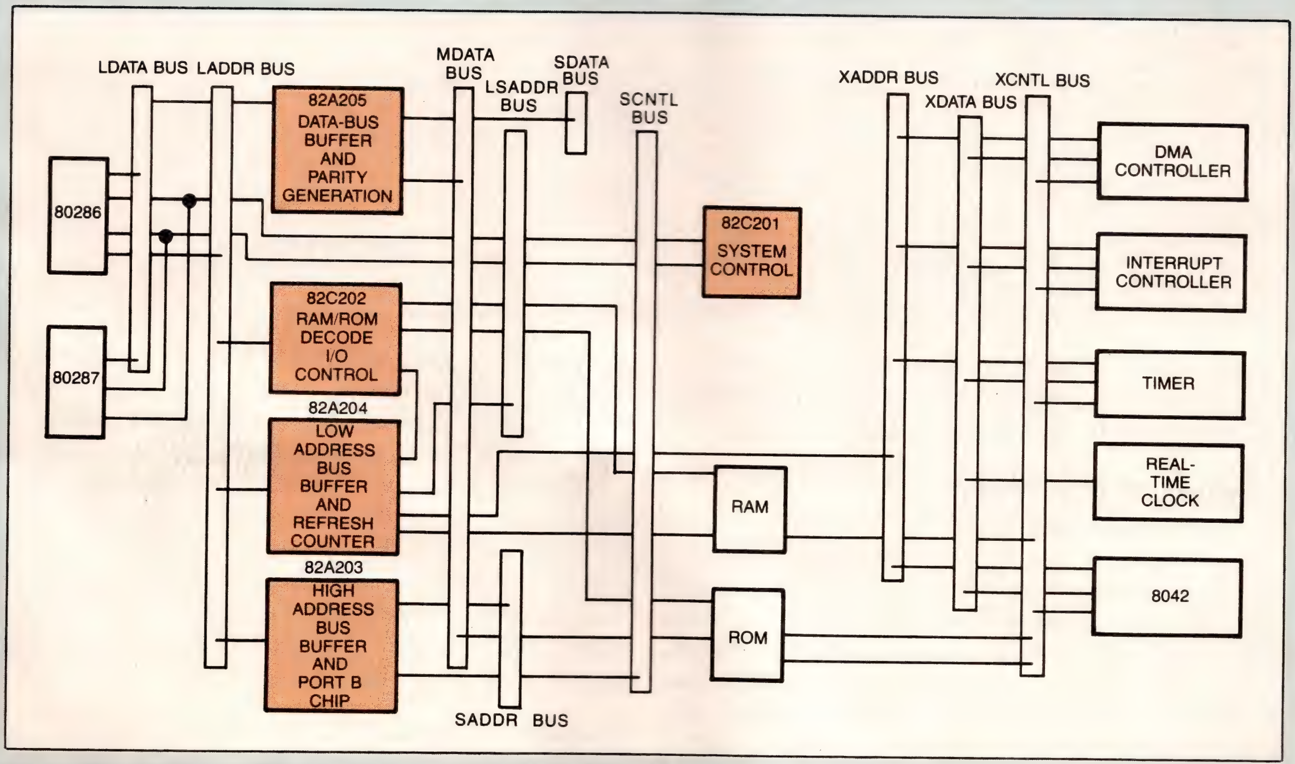


*Fig A—**If you build your SBC directly from ASICs** like the Chipset from Chips and Technologies, you can realize even greater space savings than commercially available PC- or PC/AT-bus SBCs afford.*

The SBC's lower number of parts and consequent reduction in potentially problematic interconnect circuitry results in greater reliability.

TABLE 1—SINGLE-BOARD COMPUTERS FOR THE PC AND PC/AT BUSES

COMPANY	PRODUCT	RAM (×1 BYTE)	MAXIMUM EPROM (BYTES)	CLOCK SPEED (MHz)	PROCESSOR	PORTS*	NUMBER OF DMA CHANNELS	NUMBER OF TIMING CHANNELS
ACTION INSTRUMENTS	B880	640k	64k	4.77	8088	K	4	3
FARADAY	BUS PC	256k	64k	4.77	8088	2S, K, P	4	3
	MICRO PC	256k	64k	4.77	8088	K	4	3
	BUS AT	512k (×2 BYTES)	64k	6, 8, or 10	80286	K	7	3
I-BUS	B88	256k	256k	4.77	8088	K	4	3
	R188	256k	256k	4.77	80188	S	4	3
	Y88	256k	256k	4.77	8088	S	4	3
	F286	512k (×2 BYTES	256k	6, 8, 10, OR 12	80286	S, K	7	3
ICS	CPU1	SEE COMMENTS	32k	4.77	8088	K	4	3
	PC/CPU286	640k (×2 BYTES)	32k	6	80286	K	4	3
TEXAS MICROSYSTEMS	B880	640k	64k	4.77	8088	K	4	3
	B286	512k	64k	6 OR 8 (SOFTWARE SELECTABLE)	80286	K	7	3

* K = KEYBOARD
S = SERIAL
P = PARALLEL

** FULL SIZE = 13.2 × 4.2 IN. (APPROX)
HALF SIZE = 6.2 × 4.2 IN. (APPROX)

backplane. Cutting the SBC's size and power consumption in half won't help much if your system also contains a full-sized I/0 card that consumes 20W.

Bare-bones system at lower cost

The CPU1 card from ICS supplies minimal SBC functions: the CPU and support circuitry, DMA and timer channels, and a keyboard port. The card suits simple, low-cost applications that require minimal memory and perhaps a single data-acquisition board. ICS does offer a multifunction RAM card for $395, but with IBM PC clone prices now as low as $507, this approach is effective only when size or environmental constraints preclude the use of a PC or a compatible system.

When ease of maintenance rather than size is your chief concern, you should consider a line of boards for the PC bus from Action Instruments. Each board is enshrouded in a metal case to prevent shock or displacement due to vibration. The entire system fits into a NEMA-1 enclosure. The SBC member of the family has a maximum of 640k bytes of RAM, 64k bytes of EPROM, and a keyboard port. The SBC is part of a system that includes the backplane and a power supply. The shrouding arrangement restricts your choice of other boards—a PROM board, for example—to other members of the family.

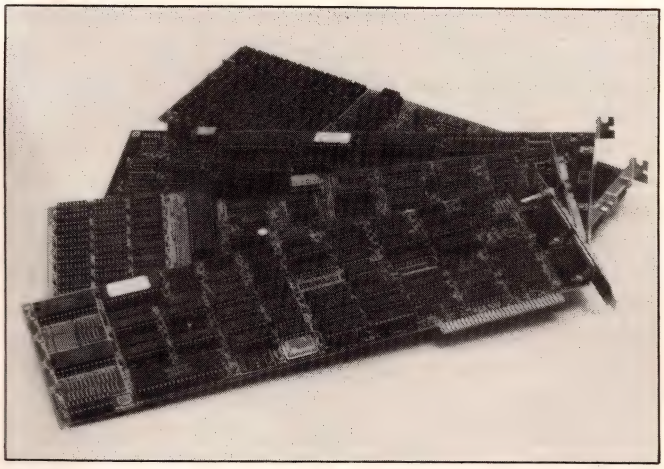
MS-DOS for diskless systems

As noted earlier, some industrial environments are harsh, and in such cases you may want to avoid using a disk and run your system entirely from EPROM. Each

CALENDAR	INTERRUPTS	SIZE**	POWER	COST	COMMENTS
NO	8	FULL	1.8A AT 5V	$2995	PRODUCTS SOLD ONLY AT SYSTEM LEVEL; PRICE INCLUDES BACKPLANE, ENCLOSURE, SBC, AND POWER SUPPLY
YES	8	FULL	2A AT 5V 50 mA AT 12V 50 mA AT −12V	$495	SERIAL PORTS: ONE RS-232C, ONE RS-232C OR RS-422
NO	8	HALF	500 mA AT 5V	$440 $550 (CMOS)	CMOS VERSION: 300 mA AT 5V
YES	16	FULL	5A AT 5V	$1190 (6 MHz) $1325 (8 MHz)	
NO	8	FULL	1.4A AT 5V	$620	
NO	8	FULL	1.1A AT 5V 20 mA AT 12V 20 mA AT −12V	$555 (64k-BYTE RAM) $620 (256k-BYTE RAM)	
NO	8	FULL	1.4A AT 5V 20 mA AT 12V 20 mA AT −12V	$620 (64k-BYTE RAM) $685 (256k-BYTE RAM)	CMOS VERSION: 300 mA AT 5V (NO ADDITIONAL CHARGE)
NO	16	FULL	2.5A AT 5V	$1199	
NO	8	FULL	1.2A AT 5V	$395	MULTIFUNCTION RAM BOARD, $395
YES	16	FULL	3.8A AT 5V	$1095	
NO	8	FULL	1.8A AT 5V	$495 (64k-BYTE RAM) $765 (640k-BYTE RAM)	
YES	16	13.3 × 5.5 IN.	2A AT 5V	$129 (512k-BYTE RAM) $1495 (1M-BYTE RAM)	BACKPLANE ACCOMMODATES LARGER BOARD SIZE

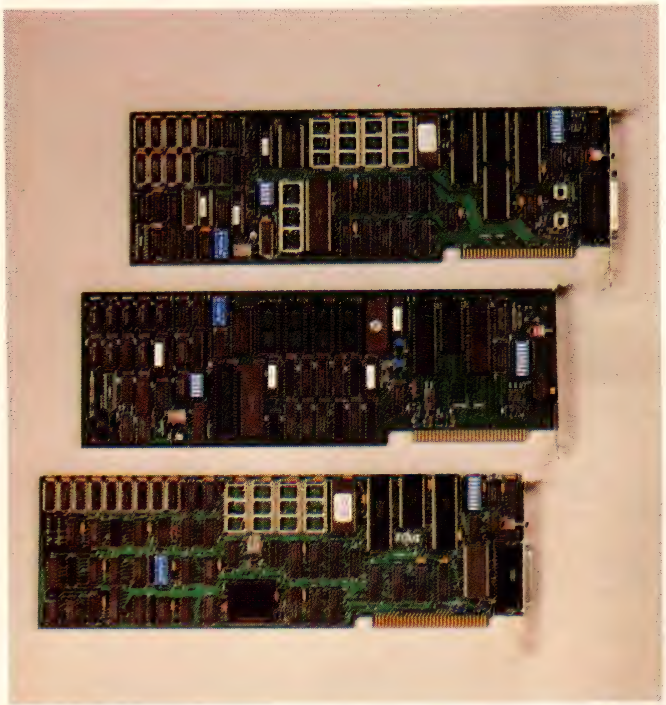
of I-Bus Systems' boards has four sockets available for EPROMs, yielding a maximum capacity of 256k bytes. The company's $1995 PROMdisk software package allows you to create a sequential binary or hex file on your PC development system's disk. You can then download this sequential file to your EPROM burner to create the EPROMs for your SBC.

Keep in mind that you may periodically need to back up your system's RAM, and you might consider using a serial port for that purpose. In a departure from the arrangement of the IBM basic input/output system (BIOS), which specifies ports COM1 and COM2 as communications ports, I-Bus configures its SBC's serial port as COM0. This port can serve as an interface to an ASCII terminal, a modem, or a host computer. If your system will not normally require a keyboard and



CPU board (front) and multifunction cards (ICS)

> *A system employing a passive backplane and an SBC is a modular one, and repair of a system function can consist of replacing a single board.*



Single-board computers for the PC-bus passive backplane *(I-Bus Systems)*

display, but you'd like to accommodate one for occasional use, you can temporarily connect a dumb terminal to COM0, make any changes you desire, and then remove the terminal.

An operating system like MS-DOS is a necessity for the PC and compatibles, but you may not need it for an application-specific system. Many applications run only one program; you may chiefly be using DOS to load in the code and transfer control to it. If such is the case with your system, and you don't need DOS's file-handling capabilities, then you may be able to fit your application program into the EPROM on the SBC. You'll have to write drivers for the system's I/O, however.

If your design needs an external 16-bit data bus, more than eight interrupts, or the capability to address more than 644k bytes of RAM, you should consider the PC/AT bus. Remember, though, that the IBM PC/AT is relatively new, and only a small number of boards take advantage of the wider address and data bus. For example, currently only one analog I/O board, the $1595 DT2821F from Data Translation (Marlboro, MA), employs the 16-bit data bus. In addition, the majority of the improvement in system speed for the IBM PC/AT comes not from the wider buses, but from the faster clock speed and more efficient architecture of the 80286.

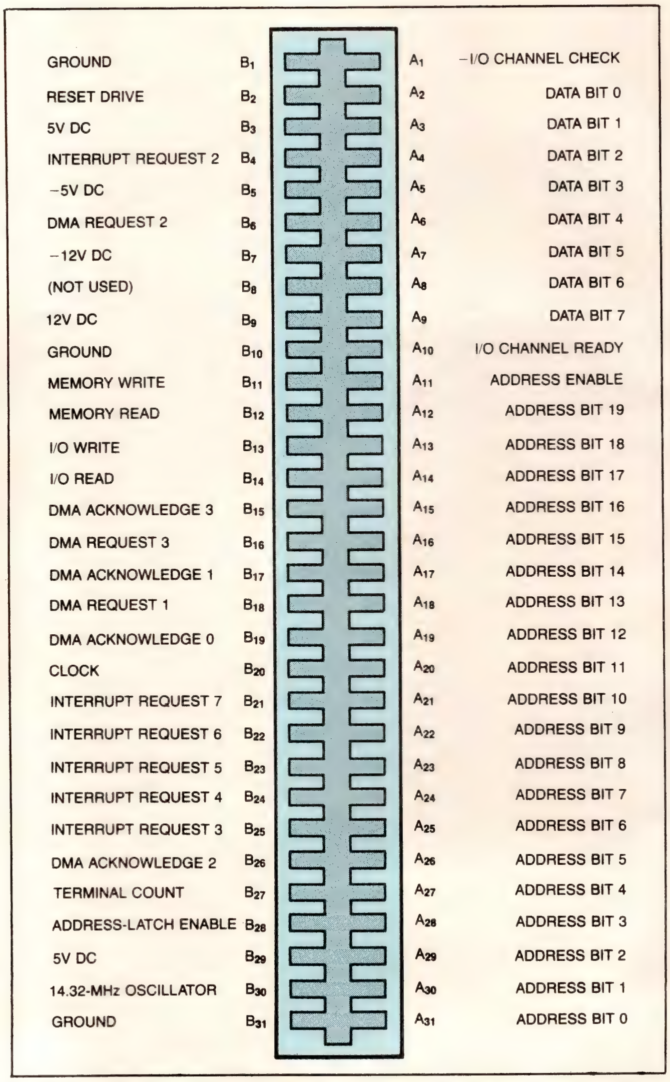


Fig 1—Most of the connections of the PC bus *and the lower 62 pins of the PC/AT bus are the same, allowing you to run a PC/AT 80286-based board on the PC bus and take advantage of the 80286's higher clock speeds. The one exception: The PC bus doesn't use pin B_8, while the PC/AT bus uses that pin to signal a zero wait state.*

One company, ICS, suggests that for greater speed than PC-bus SBCs can supply, you can plug an 80286-based PC/AT SBC into the PC bus. Physically, the company's PC/CPU286 board is compatible with the PC-bus connector (**Fig 1**); that connector shares the lower 62 pins of the PC/AT connector. One of those pins is unused by the PC bus; the PC/AT bus designates that pin as a zero-wait-state (0WS) pin and uses it to signal the PC/CPU286 that no wait state is necessary for a memory transfer. The PC/CPU286 has 640k×2 bytes of

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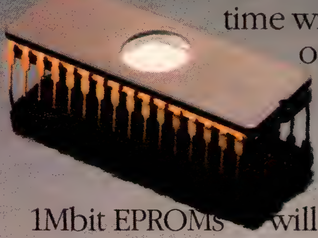

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CIRCLE NO 55

If your design needs an external 16-bit data bus, more than eight interrupts, or the capability to address more than 1M byte of RAM, consider the PC/AT bus.

RAM, enabling you to keep the speed advantage that the wider bus offers for memory transfers.

The 80286-based boards differ mainly in the amount of onboard RAM and the clock speeds. Texas Microsystems' B286 has 1M byte of RAM on board, and you can select either a 6- or 8-MHz clock speed via software. All the other boards' clock speeds are fixed at the factory. The F286 board from I-Bus has the least amount of onboard RAM (256k bytes), but it's available with clock speeds of 6, 8, 10, or 12 MHz, and it furnishes a serial port and a keyboard port. **EDN**

Reference

Terry, Chris, "Ruggedized IBM PCs and compatibles serve in low-cost industrial systems," *EDN*, January 23, 1986, pg 79.

Article Interest Quotient (Circle One)
High 488 Medium 489 Low 490

For more information . . .

For more information on the SBCs and chip sets described in this article, contact the following manufacturers directly or circle the appropriate numbers on the Information Retrieval Service card.

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I-Bus Systems
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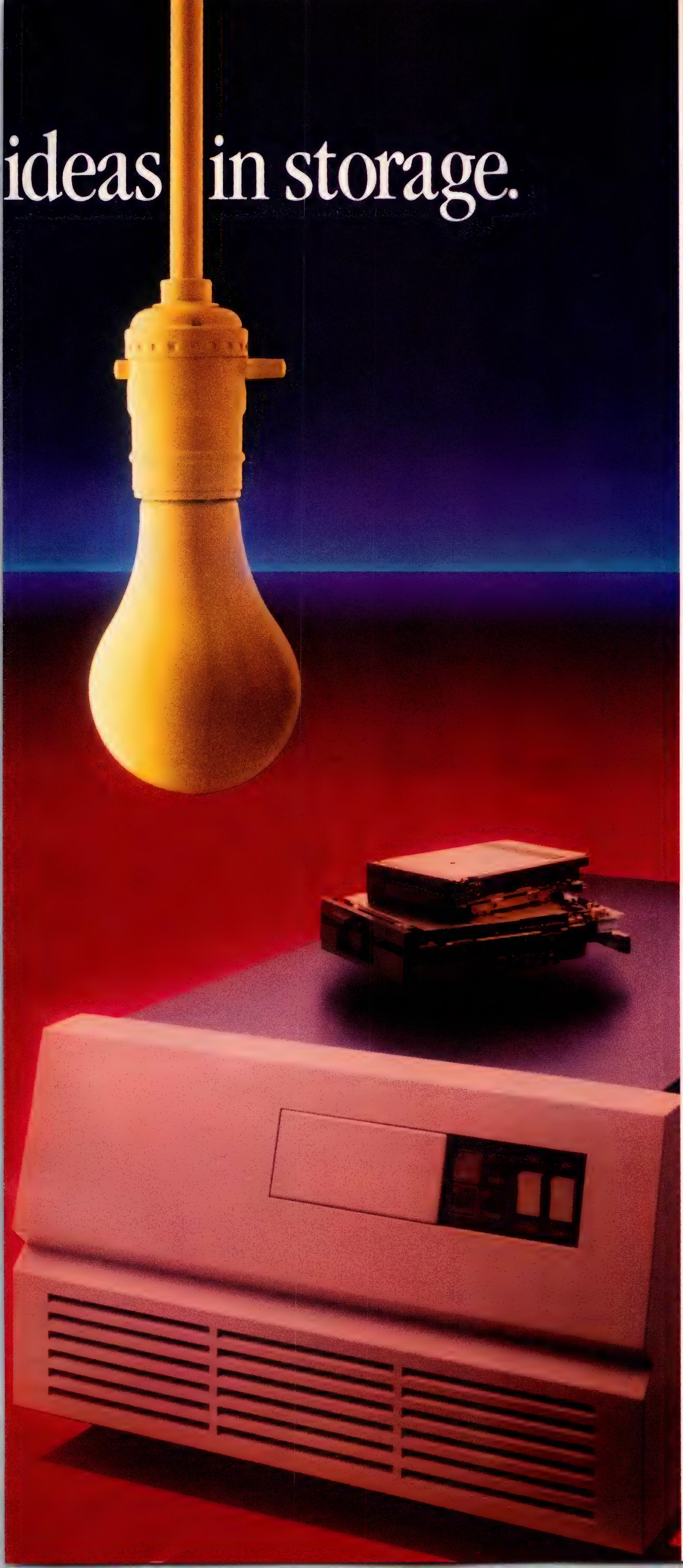

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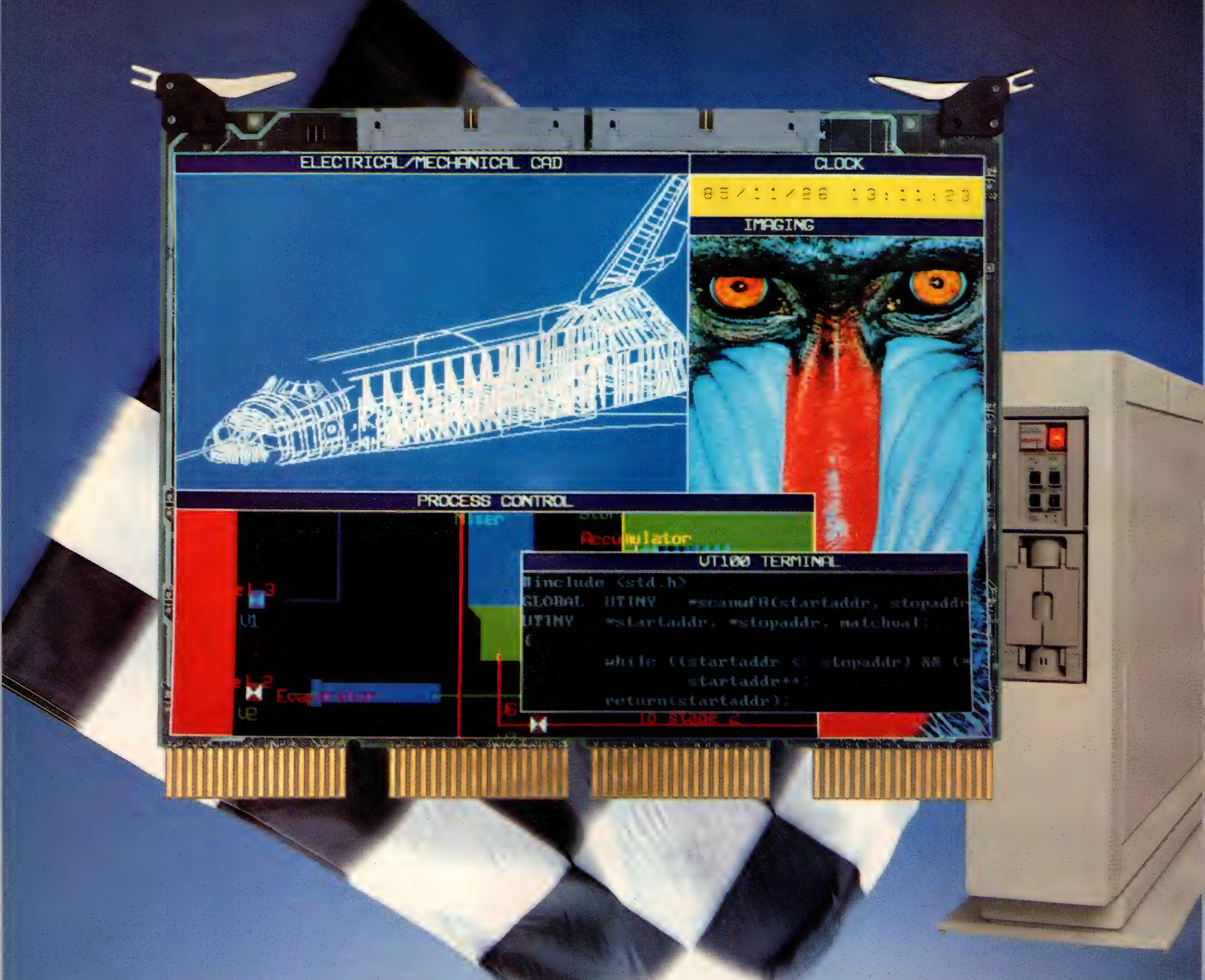
FFFAST MicroVAX Graphics



```
#include <std.h>
GLOBAL  UTINY   *scanufB(startaddr, stopaddr
UTINY   *startaddr, *stopaddr, matchval;
{
        while ((startaddr <= stopaddr) && (*
                startaddr++;
        return(startaddr);
```

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Software and Multifunction...
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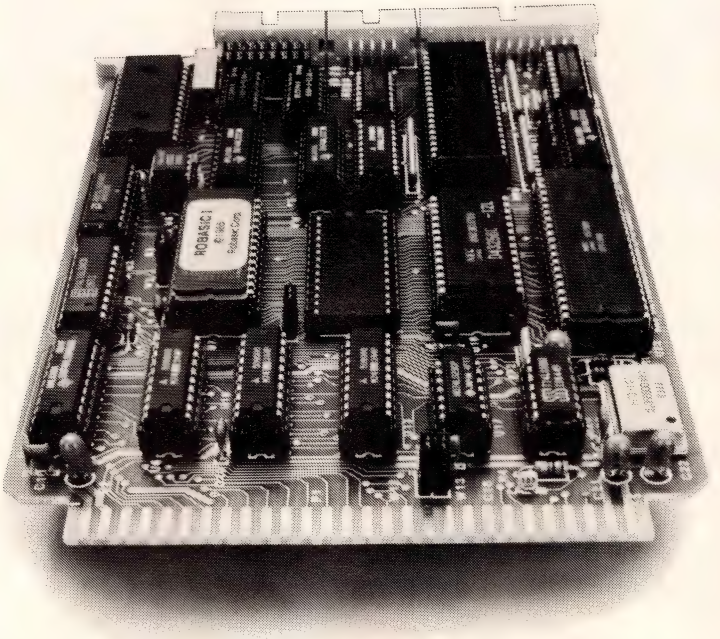

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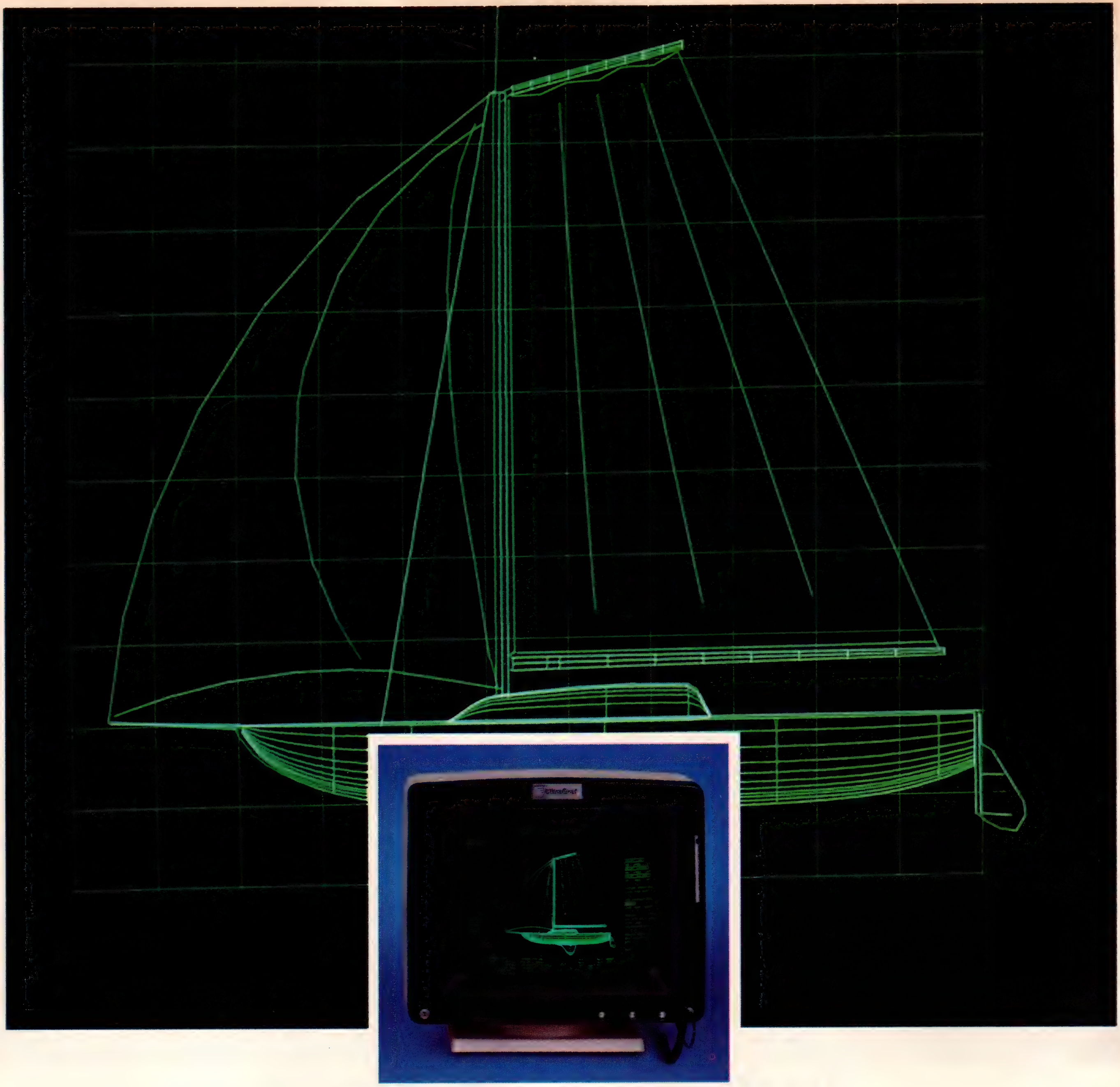

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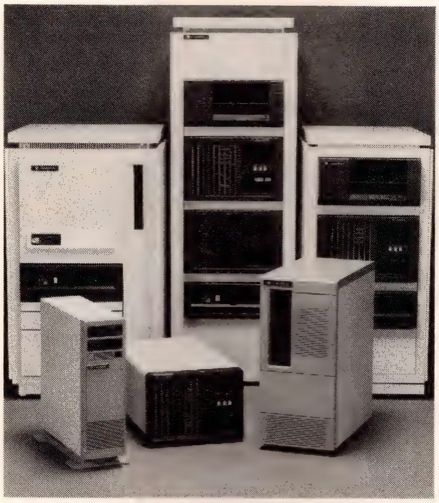
CIRCLE NO 61

Four 32-bit Multibus computers run System V and 4.2 BSD Unix

The MCX family of 32-bit computers, four Multibus machines based on the 16.7-MHz MC68020 μP, range from the 12-user MCX-3 Model 40 to the 64-user, multiprocessor MCX-5 Model 70. All models include the MC68881 floating-point math coprocessor, which yields a performance of 1.5 MIPS for single-precision operations and 1 MIPS for double-precision operations.

An optional floating-point accelerator (FPA) can increase respective single- and double-precision operation performance to 3.6 and 2.8 MIPS. The FPA, which has its own MC68881 coprocessor, communicates with the CPU over a special bus, thereby leaving the memory bus free for other operations.



All four family members incorporate an 8k-byte cache memory, demand paging, and virtual memory capacity from 256M bytes (MCX-3 Model 40) to 4G bytes (MCX-3 Model 60 and MCX-5 Models 60 and 70). I/O facilities include serial ports that yield data-transfer rates as high as 38.4k bps and SCSI device interfaces for disk- and tape-storage devices.

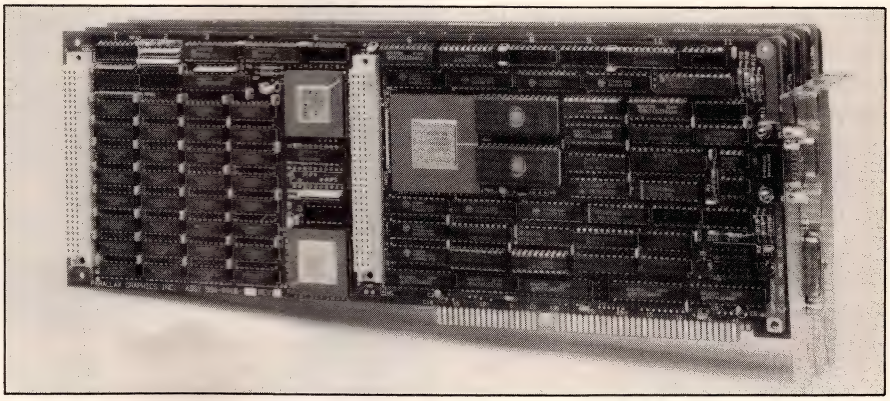
The vendor's UNIX implementation is compatible with System V and 4.2 BSD versions; each user can independently select one of these two environments. Other vendor-supplied software includes optimizing compilers for Ada, C, and Fortran. $18,700 to $73,000.

Harris Corp, Computer Systems Div, 2101 W Cypress Creek Rd, Fort Lauderdale, FL 33309. Phone (305) 973-5215.

Circle No 682

Graphics coprocessors generate noninterlaced 1280×1024×8-bit displays

The 1280 Series, graphics coprocessors for computers based on the IBM PC/AT bus, are available in two versions: A basic version with an 8-bit-plane memory, and a version with additional windowing facilities. The basic coprocessor unit consists of three PC/AT boards; the windowing facility adds another board. Both versions generate bit-mapped, noninterlaced displays with 1280×1024-pixel resolution.



The coprocessor can appear to the host as a number of device registers mapped into the main memory address space. The host then transfers data to the coprocessor by means of memory store instructions. Alternatively, the coprocessor can use DMA transfers to fetch commands and data from main memory; DMA operations may be either buffered or unbuffered to meet specific software requirements.

The board provides the user with primitive drawing commands to create boxes, circles, polygons (with as many as 128 vertices), and text. Various other commands aid in drawing vectors, specifying fill patterns, loading and unloading images, and panning and zooming.

The windowing coprocessor can accept NTSC video input from any source (including videodisk players and VCRs), process the signal, and display the result within any window. From $5000.

Parallax Graphics Inc, 1095 E Duane Ave, Sunnyvale, CA 94086. Phone (408) 720-1600. TLX 550172.

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The Pixelmaster printer uses solid plastic ink crayons, which overcome the bleeding and jet-clogging problems associated with the water- and oil-based inks of conventional ink-jet printers. In the proprietary Thermo-Jet process, the plastic is melted, piped to the ink jets, and fired in drops measuring 0.005 in. or less. The ink solidifies on contact.

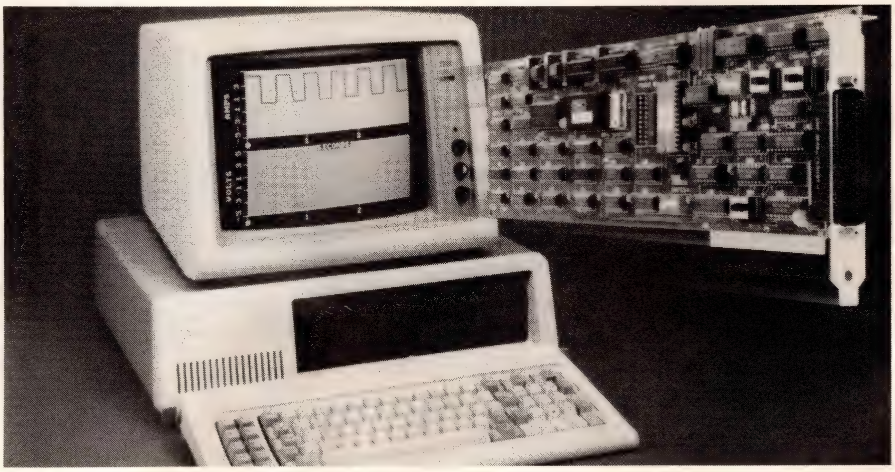
This subtractive process, similar to color printing, creates over 250,000 shades of color by superimposing drops of black, yellow, cyan, and magenta ink on paper. The end result gives an embossed effect and near offset-quality printing. The printer generates a page of black text in 30 sec and a page of color graphics in approximately four minutes. Resolution is 240×240 dots/in.

Plug-in ROM cartridges contain the data that defines the type fonts. You can have as many as 16 fonts in memory at any given time, and you can use cartridges containing logos, signature blocks, forms, and graphic images. Plug-in interface cards include RS-232C, Centronics parallel, Ethernet, and SCSI. Firmware allows the printer to emulate Diablo 630 and HP-PCL laser-jet printer protocols, as well as such graphics protocols as CGI (Graphics Software Systems, Portland, OR) and HPGL (Hewlett-Packard, Palo Alto, CA). $2995 (OEM qty). The vendor plans to begin shipping in September.

Howtek Inc, 21 Park Ave, Hudson, NH 03051. Phone (603) 882-5200.

Circle No 683

A/D converter for IBM PCs and compatibles yields more than 100,000 samples/sec



The DASH-16F analog interface card operates with the IBM PC, PC/XT, PC/AT, and RT PC or compatible computer. It can sample as many as 16 single-ended or 8 differential analog inputs and provide 12-bit accuracy at conversion rates of more than 100,000 samples/sec. The board also provides two analog output channels (which have 12-bit accuracy, too), eight individually controllable digital output bits, and a programmable counter/timer that can govern sampling rates.

It occupies 16 consecutive addresses in the PC's I/O space; DIP switches allow you to set the base address to any point in the I/O address space. You can program data transfers between the analog board and the host PC, but at high sampling rates you'll have to use DMA transfers.

The vendor supplies an assembly-language driver with the board, as well as example and calibration software routines. You can order Turbo-Pascal, C, and Fortran drivers. The board operates with most data-acquisition and -analysis software packages, including Labtech Notebook, Asyst, Asystant, Snapshot Storage Scope, and Unkelscope. DASH-16F, $1095; C driver, $125; Fortran and Turbo-Pascal drivers, $95 each.

MetraByte Corp, 440 Myles Standish Blvd, Taunton, MA 02780. Phone (617) 880-3000. TLX 503989.

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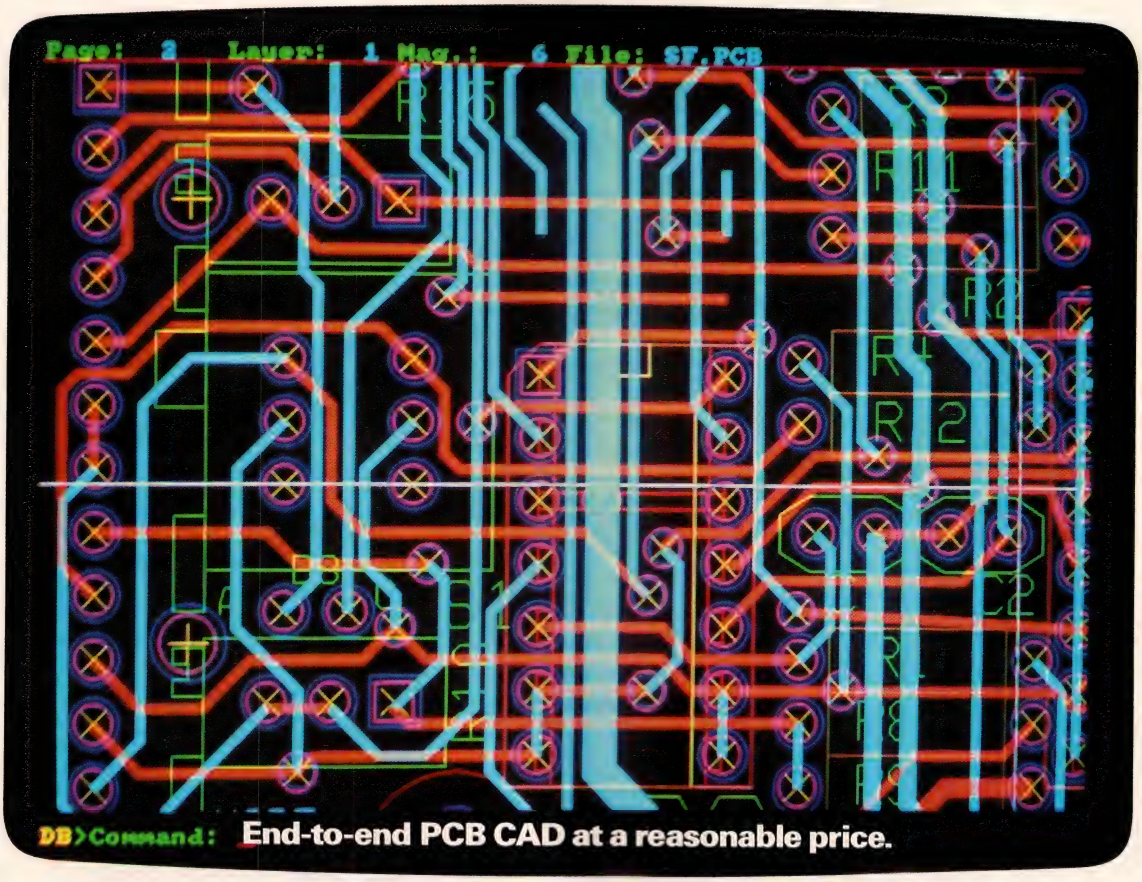
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R15
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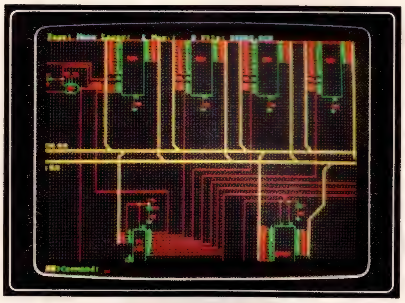

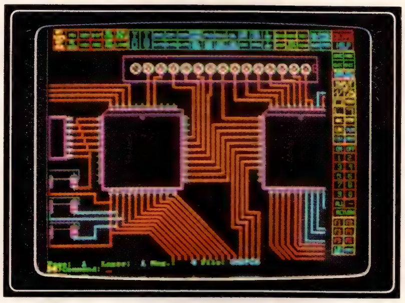

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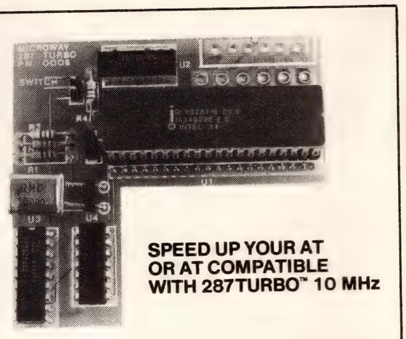

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287Turbo™ 10 MHz If you own an AT, Deskpro 286 or AT compatible, this is the card you need to get reasonable numeric performance. It plugs into your 80287 socket and includes a specially driven 10 MHz 80287. The card comes in three configurations. The IBM AT version includes a hardware RESET button **$450**

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87/88Turbo™ is a stubby card which includes a clock calendar and a speed controller which changes the speed of your motherboard from 4.77 to 7.4 MHz. Its use requires your PC to have a socketed 8284. Typical speed increase is 1.6 to 2.0. The card overcomes slow hardware by slowing up only when such devices are accessed and running at full speed otherwise **$149**
Optional 8087-2 .... **$149**

286TurboCache™ This new MicroWay accelerator uses 8K of cache memory and 80286/80287 processors to provide an average speed increase of 3:1 for most programs. Call for specifications and benchmarks **$595**

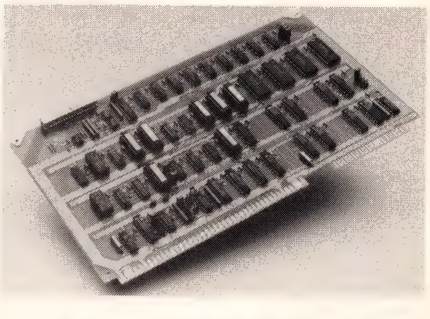
Call for our complete catalog of software which supports the 8087.

Multibus camera/computer interface allows simultaneous storage and processing

The SB6024 camera/computer interface board allows you to directly couple the vendor's diode-array line- or circular-scan cameras to a Multibus-based computer. The board accepts digital data from the camera and processes this data in one of two modes. One mode lets you store the position of each light-to-dark or dark-to-light transition for each complete line scan; the other stores the number of light or dark pixels between one transition and the next, thereby providing some compression of the data.

Two 512-byte memory blocks provide double buffering of the camera data: You can transfer the data representing one scan line from one memory block to the host while storing new data from the next scan line in the other memory block. Transfer speeds can reach 2M pixels/sec. A summary word in the first address of each block indicates the total number of transitions or groups contained in the associated scan line. You can map both memory blocks into the address space of the host computer so that they're immediately available to the CPU without I/O or DMA transfers.

To change from the transition-address mode to the pixel-counting mode—or vice versa—you write to bit 1 of the command/status register. Other bits in this register monitor the buffer status, light conditions, and error conditions. A separate buffer allows the host CPU to indicate when it's finished with the data contained in the buffer currently connected to the Multibus. You can configure the interface board for either 8- or 16-bit data transfers to the host. $895.

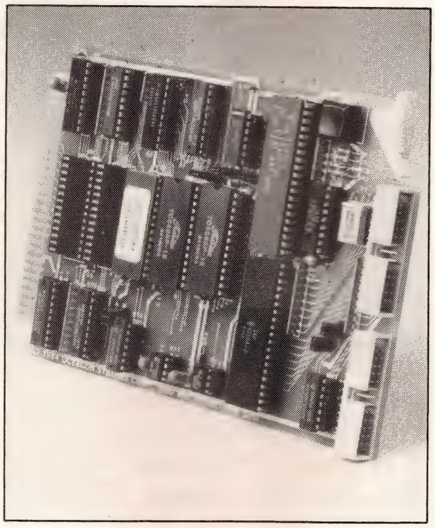


EG&G Reticon, 345 Potrero Ave, Sunnyvale, CA 94086. Phone (408) 738-4266.

Circle No 684

Multifunction CPU board for STD Bus includes multitasking Basic in ROM

The 880B, a control processor for the STD Bus based on the 5.12-MHz 8088 CPU chip, comes with 16k bytes of RAM. You can mix ROM, EPROM, and RAM for a total address space of 192k bytes. Memory capacity on the CPU card is expandable to 64k bytes; you can expand it to 192k bytes total by using expansion memory cards (each of which can have 128k bytes max). Sockets on the CPU card can hold as much as 32k bytes of EPROM, and the ROM-resident Robasic interactive compiler occupies 64k bytes.



The main RS-232C port consists of a programmable, interrupt-driven hardware UART that transfers data at rates of 50k to 19.2k bps; a handshake line allows the connection of slow serial devices. An auxiliary RS-232C port consists of an interrupt-driven software UART with data rates of 300 and 1200 bps only. The board has one parallel, 16-line I/O port; you can program individual lines for counter, interrupt, or serial communications via software. It also has five 8-bit counter/timers, one of which the system uses; you can cascade the others in pairs to form 16-bit counters.

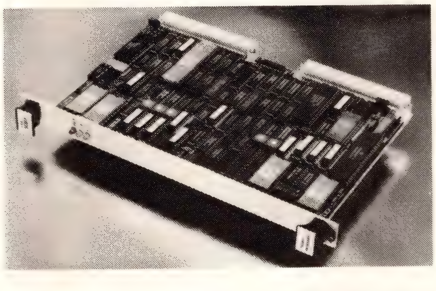
Robasic is an enhanced, interactive Basic compiler with commands that address real-time, multitasking control and measurement problems. You can program as many as 16 concurrent tasks, and the Robasic scheduler executes each task in sequence. This process isn't automatic, however; you must state in your program when one task should relinquish control to another, and no task can pre-empt another task unless you specifically allow it to do so by statements in the program. $595.

Octagon Systems Corp, 6510 W 91st Ave, Westminster, CO 80030. Phone (303) 426-8540.

Circle No 689

VME/SCSI Bus interface board yields data-transfer rate of 1.5M bytes/sec

The PME SCSI-1, a VME/SCSI Bus intelligent interface board, uses a 68008 μP to manage all onboard resources, including DMA channels to the host CPU and a SCSI bus controller. The μP operates under the control of EPROM-resident firmware, which implements all bus functions defined by VME Bus and ANSI X3T9.2 SCSI specifications. The board can handle as many as eight concurrent tasks, and the host-computer software can assign relative priorities to these tasks. Onboard firmware occupies 8k bytes of EPROM and uses 2k bytes of RAM as a scratchpad memory.



Data transfers over the SCSI Bus take place at rates as high as 1.5M bytes/sec. A 68430 DMA controller manages transfers between the interface board and the host computer's memory; these transfers occur over a 512-word FIFO buffer, 32 bits wide, which acts as a reservoir to smooth out the effects of temporary interruptions on either the VME or SCSI Bus, and thereby maintain high throughput.

The interface board operates with any VME Bus system that allows 24- or 32-bit addressing, and it generates all appropriate modifier codes. You can set the board's base I/O address to any 2k-byte boundary within the 32-bit VME Bus address space. $1660.

Plessey Microsystems, 1 Blue Hill Plaza, Pearl River, NY 10965. Phone (800) 368-2738; in NY, (914) 735-4661.

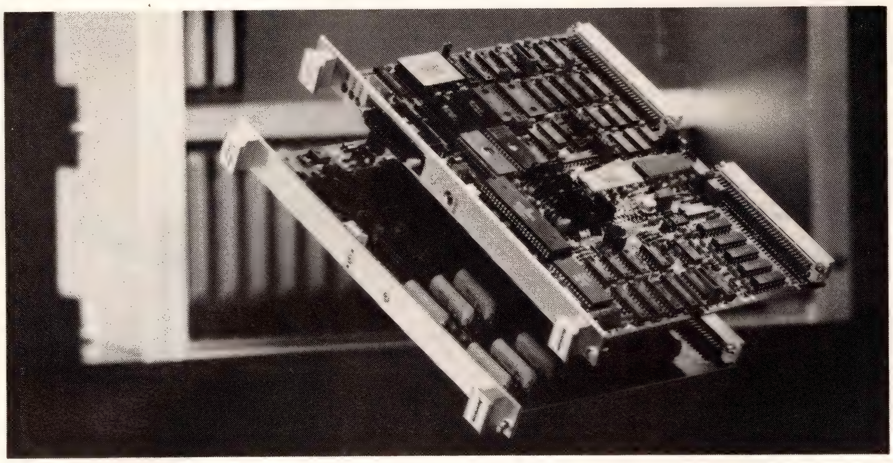
Circle No 686

Analog subsystem card for the VME Bus handles differential, single-ended inputs

The intelligent base card (IBC) is a double-height board for the VME Bus. It can act as the controller for an extensive analog input subsystem (Model AVME9100) or, if equipped with input modules, it can act as an interface to 16 differential or 32 single-ended analog input channels (Model AVME9110). Its onboard 68000 μP and firmware relieve the VME host CPU of functions such as A/D conversion, linearization, and scaling.

The board can operate as a standalone unit or, with the addition of an expander-bus backplane and expansion cards, it can control as many as 256 channels. The backplane expander fits in the lower half of the chassis and mates with the J2/P2 connectors of the IBC and associated expansion cards.

The board includes autozero circuitry and can accept an external trigger signal to synchronize A/D conversion with external events.



Accepting input signals as large as ±10V, it features protection against continuous overvoltages to ±32V and momentary surges of several hundred volts.

A built-in RS-232C port with a front-panel connector allows connection of a terminal for startup, maintenance, and troubleshooting. Pass/fail/halt LED indicators on the front panel operate in conjunction with the onboard firmware's diagnostic routines. The firmware also includes routines for linearization and scaling of thermocouple and RTD data. Model AVME9100, $1395; AVME9110, $1595.

Acromag, 30765 Wixom Rd, Wixom, MI 48096. Phone (313) 624-1541. TLX 247354.

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CIRCLE NO 64

So, Is There a Real ASIC Second Source Setup in the Picture?

(Hint: Raytheon's RL7000 and LSI Logic's LL7000 are like . . .)

There's been a lot of wishful thinking about an active, genuine, semi-custom logic array second source. For very good reasons, but without a very good solution. Now, the right people, technology, and systems have been brought together. Raytheon and LSI Logic. It's happening.

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☐ **The Right Product:** According to the marketplace, 7000 Series is the leading choice in 2-micron HCMOS logic. Now, with a full-on second source, 7000 Series is the ASIC standard.

☐ **It's Happening:** Raytheon has over ten years of logic array experience. LSI Logic has over five. Real time, in the market, with real products.

☐ **Now:** You ought to can the apples and oranges routine. Call Raytheon for a real ASIC matchup.

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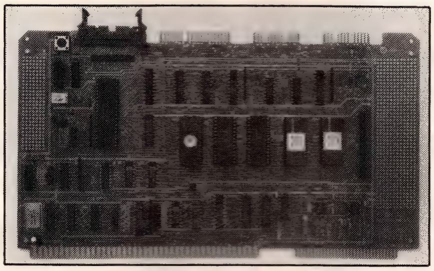
CIRCLE NO 65

Programmable Multibus motion controllers can function as stand-alone units



The DMC-200 (2 axis) and DMC-201 (1 axis) digital motion controllers precisely position dc or brushless dc motors and can operate as stand-alone units or under control of a Multibus-based system. Both units have a built-in μP and respond to commands in the form of ASCII strings. In the stand-alone mode, the command sequences can reside in onboard nonvolatile memory. In applications where a host computer originates the motion command sequences, the CPU can transmit commands over the Multibus or via the built-in RS-232C interface. The serial link lets you mount several controllers in a Multibus expansion box located at a distance from the host computer.

You can operate the controllers in point-to-point positioning, velocity-profiling, and phase-locked speed-control modes; position, speed, and velocity are all programmable. Each command consists of a 2-character operation code followed by one or more characters representing the X or Y axis (DMC-200 only) or variables representing motion parameters. Conditional commands let you test the status of I/O lines, the completion of the last motion command, the current position, and elapsed time. The controllers generate interrupt requests for error, motion-complete, and sequence-complete conditions; the priority of the interrupts is jumper selectable. DMC-201, $665 (100).

Galil Motion Control Inc, 1928-A Old Middlefield Way, Mountain View, CA 94043. Phone (415) 964-6494.

Circle No 685

Laser printer has 2M bytes of RAM and can operate in plotting mode

The LP-3000 laser printer comes with 512k bytes of RAM, expandable to 2M bytes, for applications that require an 8½×11-in. page of bit-mapped graphics. Horizontal and vertical resolution is 300 dots/in. With the HPGL option, the printer can operate in a plotting mode; HPGL is an interpretive language that translates the vector data sent to a plotter into a format that allows a raster device to display the same image. The HPGL language resides in a plug-in ROM-cartridge.

The printer comes with six standard resident character fonts: Courier 10-pitch (Roman and italic), Prestige Elite 12-pitch, condensed (16.67 cpi), Times Roman proportional spacing, and the IBM character set. The vendor offers other fonts in plug-in ROM cartridges, or you can download fonts from your computer. You can mix as many as 16 fonts on a page and choose from the following printing styles: boldface, portrait, landscape (sideways), and underlined.

Centronics parallel and RS-232C interfaces are standard. Print speed is 8 pages/minute at 7000 characters/page (line-printer mode). Density is 300×300 dots/in. Input and output trays hold 250 sheets of paper; the printer can collate sheets of multipage documents. LP-3000, $3980; HPGL option, $995.

Hanzon Data Inc, 18732 142nd Ave NE, Woodinville, WA 98072. Phone (206) 487-1717.

Circle No 687

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CIRCLE NO 66

Bering introduces Bernoulli to the HP world.

The leader in innovative mass storage for HP debuts its newest removable disk subsystem for HP computers.

Bering's 8020-RM Bernoulli boasts the latest in removable disk storage technology for HP CS/80 and SS/80 computers.

The Bering 8020-RM Bernoulli

Combining Bering's disk drive expertise with proven Bernoulli technology creates a versatile primary storage drive or a highly efficient backup. It's not a hard disk, a tape or microfloppy—the 8020-RM uses removable 8″ cartridge technology to meet demanding storage needs.

Durable, reliable, fast

Bernoulli technology employs the best floppy and Winchester features. Floppy removability and durability are combined with Winchester speed and reliability. With transfer and access rates matching hard disk speeds, the 8020-RM is a high performer. The non-contact media resists head crashes and reduces data loss.

Removable storage

20MB cartridges are perfect for securing classified data. Keep an entire database on one cartridge. Protect data from accidental tampering. And expand storage simply by inserting another cartridge, each for under $100.

Winning combinations

Compare the fixed/removable combination from Bering (20MB hard disk PLUS 20MB Bernoulli) with the HP7907A. Bering's winning combination comes in at half the price—$6,250! Add $300 and get a 3.5″ microfloppy for downloading software and still come out ahead! The 8020-RM can be used with any Bering Series 8000 drive.

HP compatibility

The 8020-RM is 100% hardware and software compatible with CS/80 and SS/80 computers like the HP Series 100, HP9000 Series 200/300/500, HP1000, and Vectra.

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The 8020-RM carries a one year limited warranty, reflecting Bering's commitment to quality.

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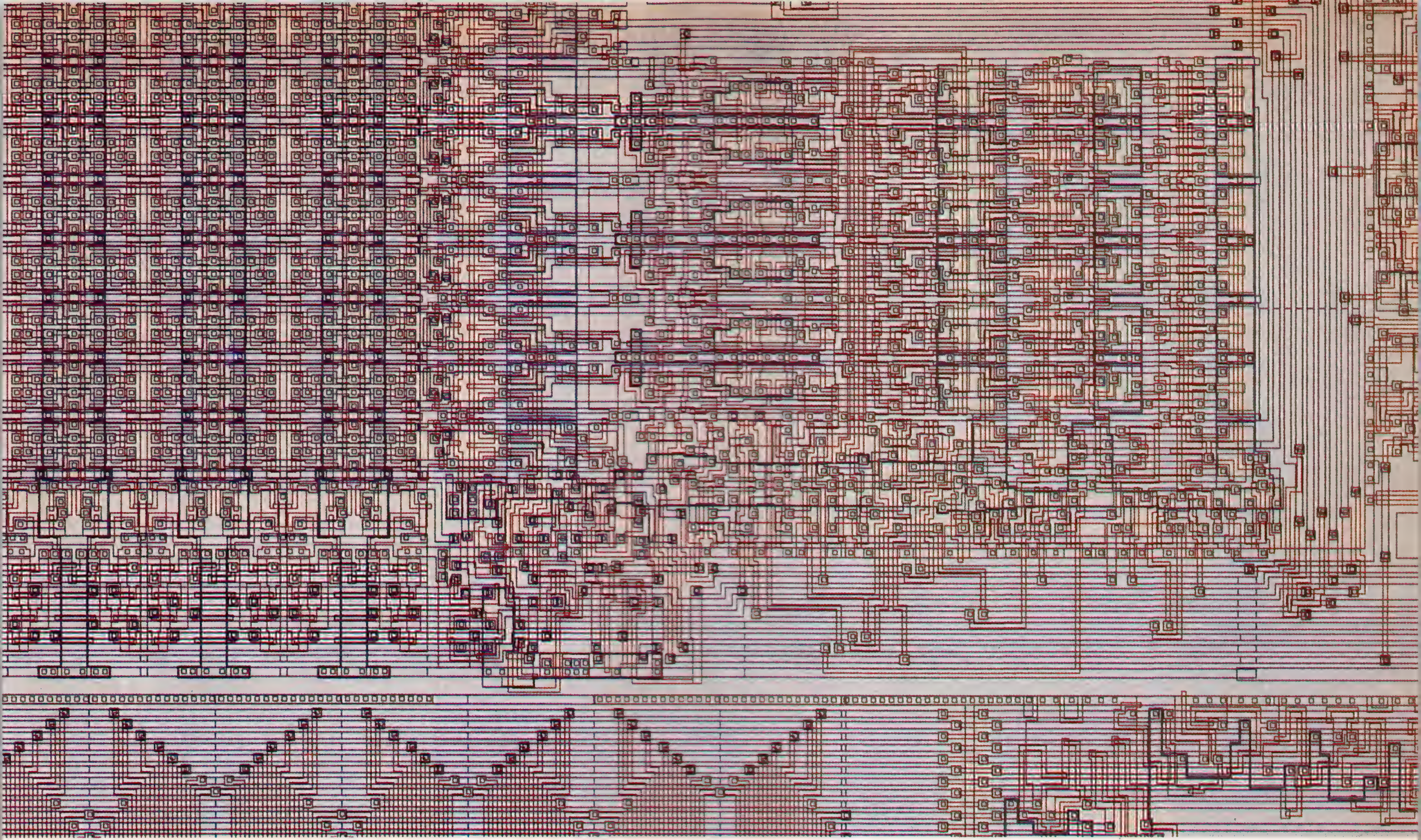
Note: Bernoulli is a tradename of IOMEGA Corporation. HP-IB, HP7907A, Series 100, HP9000 Series 200/300/500, HP1000, CS/80, SS/80 and Vectra are tradenames of Hewlett-Packard Company.

CIRCLE NO 67



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For a closer look at these resolutionary plotters, write CalComp, P.O. Box 3250, Anaheim, CA 92803. Or call 1-800-CALCOMP.

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CIRCLE NO 70

THE RASTERIZER ROADBLOCK

Users with old-fashioned multi-pass color electrostatic plotters have to wait up to two hours for an E-sized plot to be rasterized before the plotter begins plotting! Thanks to Benson, there's now a better way to obtain large-scale, full-color plots.

vs. THE BENSON BYPASS

Benson's single-pass color electrostatic plotter rasterizes "on the fly"—while the plotter plots! You'll be able to see your plots in minutes, not hours.

Benson's single-pass plotter eliminates problems associated with multi-pass plotters, like paper stretching. In Benson's plotter, the paper passes the heads only once; it doesn't go back and forth. Image registration is accomplished electronically, not mechanically. And the complex hydraulic systems needed to raise and lower toner baths in multi-pass plotters have been eliminated. Benson's proprietary writing/toning stations remain stationary as the paper passes by—in a single pass.

Benson's color electrostatic plotter, with its built-in raster engine, costs about the same as a multiple-pass plotter and a separate, "bit-mapping" controller.

This is simplicity itself—the best way to quickly generate large scale, full-color plots. Call your Benson representative for more details!*

- Built-in raster engine rasterizes as the plotter plots.
- Single-pass technology assures tighter registration.
- Generates an E-sized color plot in as little as 3.38 minutes.
- 254 dpi resolution, 256 pre-set colors and 256 user-selectable colors.

*See Computer Graphics World, March 1986: "Multi-Pass vs. One-Pass Plotters" for more information about this exciting new technology.

CIRCLE NO 69

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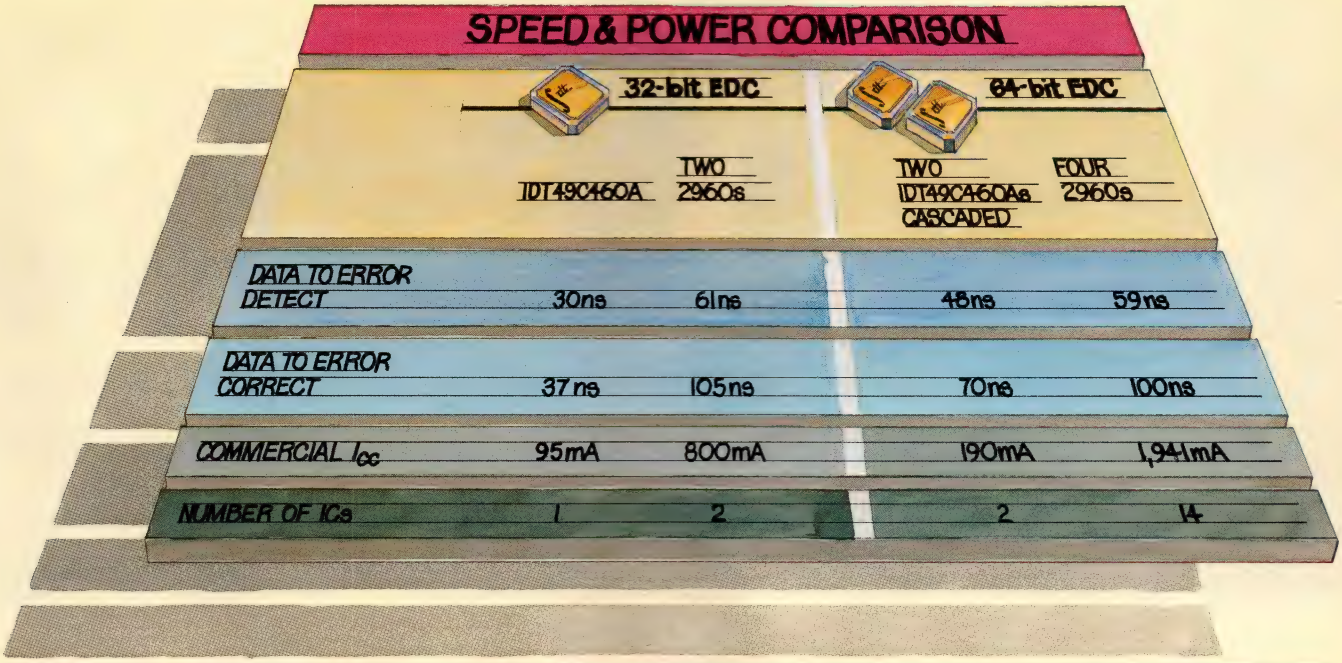

SPEED & POWER COMPARISON

	32-bit EDC		64-bit EDC	
	IDT49C460A	TWO 2960s	TWO IDT49C460As CASCADED	FOUR 2960s
DATA TO ERROR DETECT	30ns	61ns	48ns	59ns
DATA TO ERROR CORRECT	37ns	105ns	70ns	100ns
COMMERCIAL I_{CC}	95mA	800mA	190mA	1,941mA
NUMBER OF ICs	1	2	2	14

Twice as fast as two 2960s at 1/8th the power, it's hard to believe that 32-bit EDC is now this fast.

The IDT49C460A is functionally equivalent to two 2960s.

But that's where all comparisons end if you're designing with EDC.

Because the IDT49C460A is twice as fast as 2960 based designs.

Cascadable to 64-bits. Two IDT49C460As perform 64-bit EDC without additional MSI. Only IDT provides this capability.

Superior to the ALS632. The IDT49C460A is 25% faster while consuming 155mA less power than the ALS632. And the ALS632 cannot be cascaded, not even with additional MSI.

Available now. Commercial/military in a 68-pin PGA ☐ 68-pin "shrink" DIP (600 mil, 70 mil pin-centers) ☐ two 68-pin LCCs (a "fine-pitch" 25 mil pin-center and a 50 mil pin-center).

Accurate. Enhance data integrity in your main memory system. Correct all single-bit errors. Detect all double and some triple-bit errors.

Architectural enhancement. Separate byte enables for simplified byte operation and faster byte writes.

Diagnostics. All IDT EDC products contain built-in diagnostic circuitry that verifies proper EDC operation.

16-Bit EDC Speed & Power Comparison

	IDT39C60A	2960A	IDT39C60-1	2960-1	IDT39C60	2960
Data to error detect	20ns	N/A	25ns	25ns	32ns	32ns
Data to error correct	30ns	N/A	52ns	52ns	65ns	65ns
Commercial I_{CC}	85mA	400mA	85mA	400mA	85mA	400mA

Speed leadership in 16-bit EDC.

We also make 16-bit EDC in three speeds: the IDT39C60A, IDT39C60-1 and IDT39C60.

The IDT39C60A is unquestionably the fastest TTL compatible CMOS 16-bit EDC in the world. And more than just some "specs on paper," it's *available now.* Clearly establishing a new standard that others can only hope to achieve.

The IDT39C60-1 and IDT39C60 are equal in speed to the 2960-1 and 2960.

All are pin compatible and functionally equivalent to the bipolar 2960s, but have greater output drive, while consuming only 1/4th the power.

Available now. Commercial/military product in 48-pin and 52-pin DIPs and 52-pin LCCs. Or cut board space in half with our 48-pin "shrink" DIP (400 mil, 70 mil pin-centers).

Cascadable. Up to 64 bits.

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Contact our local representative, call **1-800-IDTCMOS,** or fill in the bingo for a copy of our *Application Note* explaining how to use 16- and 32-bit EDC.

Also ask for our *Product Selector Guide* on CEMOS™ **MICROSLICE,™** (bit-slice microprocessor products) **Subsystems, Memory Interface Logic, Digital Signal Processing Circuits** (multipliers, MACs and FIFOs), and one of the fastest, broadest lines of **Static RAMs** in the world.

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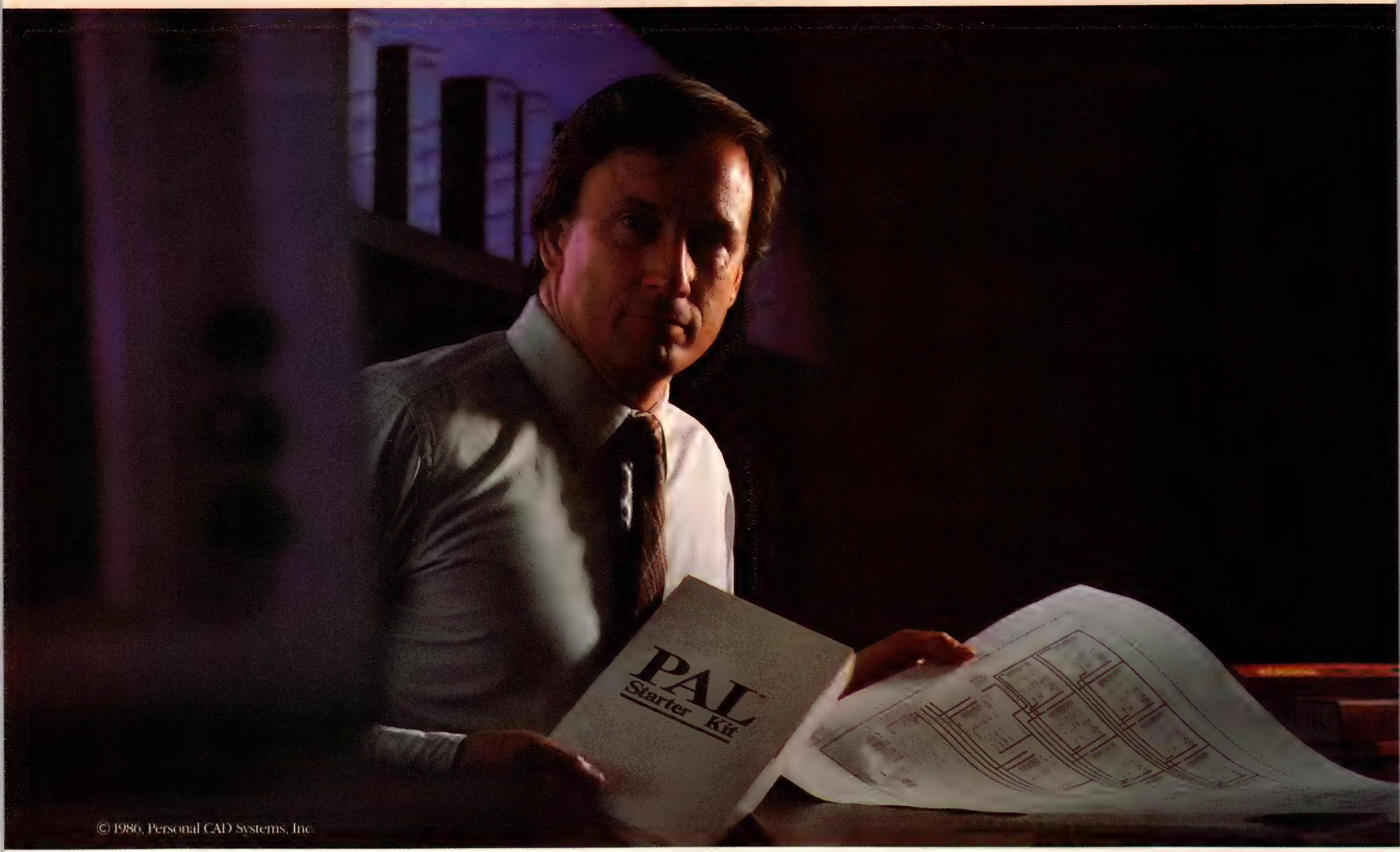
CIRCLE NO 68



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Your fastest start in PAL design.

When you replace TTL with Programmable Array Logic (PAL®) devices, you get greater design flexibility and faster design time than with any other digital logic technology.

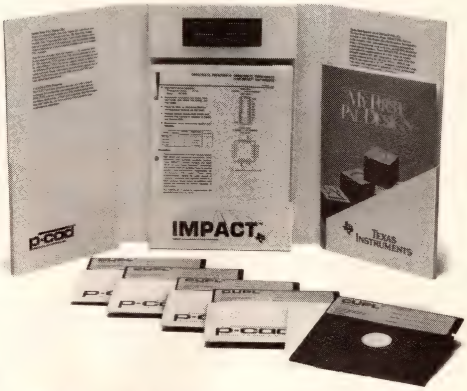
Now, Texas Instruments and Personal CAD Systems are offering a PAL Starter Kit that will give you the fastest start in PAL design. For only $49.95.*

THE FASTEST PAL DEVICES.

TI's IMPACT™ technology produces the fastest PAL devices you can buy: 12 nanoseconds fast. They can cut processing time in half for such speed-critical applications as high-resolution graphics. The Starter Kit includes one each of the TIBPAL16XX-12 series: the industry standards 16L8, 16R4, 16R6, and 16R8. Just one of these PAL functions can replace up to 10 TTL packages.

THE FASTEST PAL DESIGN LANGUAGE.

P-CAD's CUPL™ is the most powerful high-level PAL design language. With powerful logic reduction algorithms, your choice of description formats, and time-saving shorthand notation. And CUPL works with your choice of device programmer and IBM™-compatible PC-XT or AT. The Starter Kit includes user manual, and full-function software with device support limited to the four PAL functions supplied.



Texas Instruments and P-CAD present the $\$49^{\underline{95}*}$ PAL Starter Kit.

CALL 800-227-6703 FOR THE FASTEST START.

The Starter Kit also includes "My First PAL Design," an informative booklet that gets you off to the right start. All for $49.95,* plus postage and handling. (If you don't have a device programmer, contact one of the TI-authorized distributors listed in the kit for free programming of the four PAL IC's provided.) For prompt delivery, call 800-227-6703 (from CA: 800-632-7979) and have your VISA or MasterCard handy. Or send check, money order or charge card authorization to: Starter Kit, PO Box 306, Half Moon Bay, CA 94019.

With an offer like this, we're going to make a lot of new pals.

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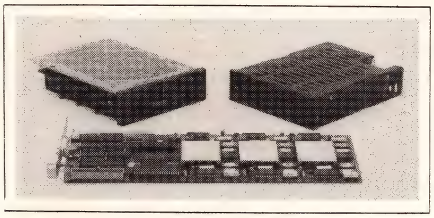
CIRCLE NO 71



BUBBLE MEMORIES

The Solidrive family of bubble-memory products for IBM PCs and compatibles comprises a full-size controller card, expansion packs, and removable cartridge packs. You can order the controller with 0.5M, 1M, or 1.5M bytes of onboard bubble memory. An expansion port allows you to connect as many as four expansion packs (each of which can store 1M or 2M bytes) or removable cartridges (each of which can store 0.5M bytes). You can combine fixed and removable storage in the same system. The vendor provides firmware that makes the bubble-memory subsystem appear to the DOS as if it were one or two hard-disk drives; you can boot the system from the bubble memory.

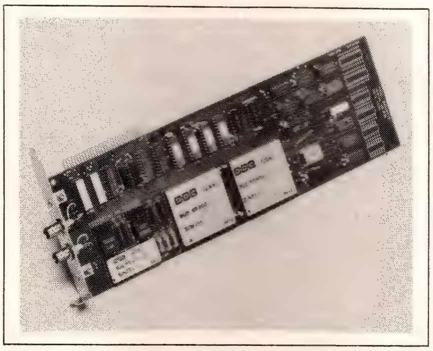
Other controller-card features include an RS-232C port, a password scheme for data protection, switchable write protection, built-in test facilities, and interrupt and DMA channels. A standard version operates over 10 to 45°C, but industrial versions that operate over 0 to 65°C are also available. A 1M-byte system dissipates 8.9W typ. Controller board prices for the commercial temperature range start at $1195 (0.5M bytes); expansion pack prices are $1995 (1M byte) and $3915 (2M bytes); the removable cartridge holder costs $315; and cartridges cost $1275 (50).

Targa Electronics Systems Inc, Box 8485, Ottawa, Ontario, Canada K1G 3H9. Phone (800) 267-9793; in Canada, (613) 731-9941.

Circle No 701

MILITARY INTERFACE

The BUS-65515 board provides an interface between the IBM PC (and compatibles) and the MIL-STD-1553 serial multiplexed bus. The vendor supplies software that allows you to configure the host PC as either a bus controller, a remote terminal unit, or a bus monitor terminal for simulating and testing MIL-STD-1553 data bus applications. This full-size card plugs into an IBM PC expansion slot and contains 4k×16-bit RAM, logic for handling I/O via the PC, address and data buffers, and prioritized interrupt-handling facilities. Jumpers allow the user to select the interrupt priority level and the mapping of the 4k×16-bit shared memory.



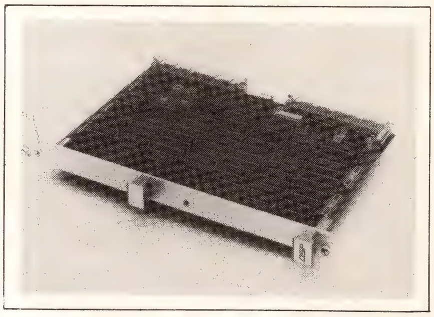
The card can store and process as many as 59 messages if you configure it as a bus controller, and as many as 107 messages if you configure it as a remote terminal unit. As a bus monitor, it keeps track of all activity on the 1553 bus, decoding and storing in memory the command, data, and status words of all messages passing over the bus. The card operates from 0 to 70°C. $4995. Delivery, four to eight weeks ARO.

ILC Data Device Corp, 105 Wilbur Pl, Bohemia, NY 11716. Phone (516) 567-5600. TWX 510-228-7324.

Circle No 702

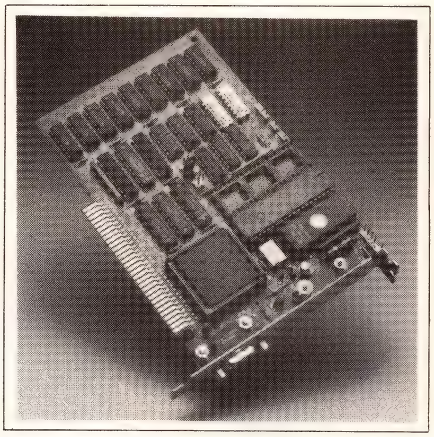
VME BUS BOARD

The VAP-FS frame store is a VME Bus board that captures high-speed data, in a manner similar to that of a digital sampling oscilloscope, for later processing at a slower speed. The frame store comprises a high-speed, 2½-port memory with a capacity of 32k 16-bit words. For data acquisition, you control the starting address, word count, and acquisition trigger via the two full ports and write the data into the memory via the remaining half port. When acquisition is complete, you can use the two full ports simultaneously to read from or write to any location within the memory. $2400.



DSP Systems Corp, 1081 N Shepard St, M/S-E, Anaheim, CA 92806. Phone (714) 630-1330.

Circle No 703



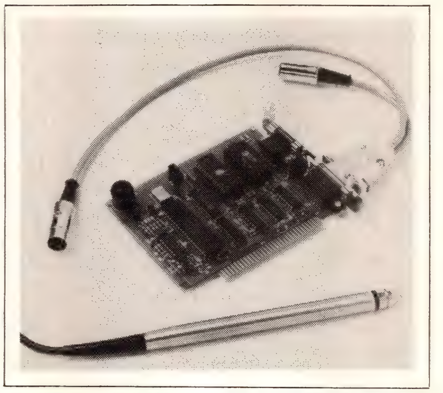
1-BOARD COMPUTER

The CMOS Micro PC resides on a 4.2×6.2-in. half-size card that plugs into one slot of an IBM PC-compatible computer with a passive backplane. The board includes an 80C88 CPU running at 4.77 MHz, a socket for an 8087 math coprocessor chip, 256k bytes of CMOS RAM, and the vendor's IBM PC-compatible, ROM-resident BIOS. The FE2010 chip, a custom ASIC that replaces 34 low-power Schottky chips and the Intel chip set (except the 8088 and 8087) of a standard IBM mother board, provides all other logic functions, including a keyboard port and a speaker port.

The board provides four DMA channels: One refreshes the dynamic memory, and the other three are available for use by boards plugged into the expansion slots. The interrupt circuitry provides a maximum of eight levels of interrupt; three timer channels are available. A 2-pin header allows you to connect an optional external switch to generate a hardware reset. $550.

Faraday Electronics, 743 Pastoria Ave, Sunnyvale, CA 94086. (408) 749-1900.

Circle No 704



BAR-CODE SYSTEM

The HBD-PC bar-code interface card plugs into a short expansion slot of an IBM PC, PC/XT, PC/AT, or compatible computer. The board has two DIN connectors: One connector plugs into the PC's keyboard socket, and the other accepts the keyboard plug. A separate connector accepts signals from a wand scanner or other bar-code read head. The standard read head is a low-resolution infrared wand; however, you can also specify high-resolution infrared and low-resolution visible-red scanners. In addition, you can use the vendor's handheld laser scanner, slot reader, or machine-mounting scanner with the interface card.

The board reads Codabar, Code 39, ASCII 3-of-9, Interleaved 2-of-5, UPC, EAN/JAN, Code 93, and Code 128, and distinguishes automatically between them. After translating the bar codes into their ASCII equivalents, which are stored temporarily in a 54-byte hardware buffer, the board presents the data to the PC as if it were a string originating at the keyboard. HBD-PC and wand scanner, $595. Delivery, six weeks ARO.

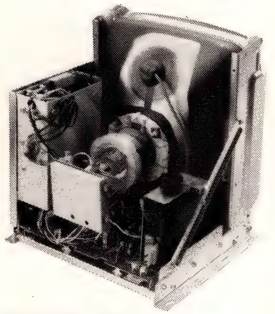
Welch-Allyn Inc, Industrial Products Div, Box 187, Skaneateles Falls, NY 13153. Phone (315) 685-8351. TLX 325435.

Circle No 705

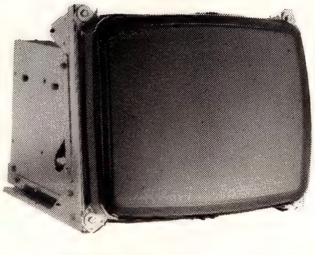
LAN CONTROLLER

The Arcnet-PC200 board for the IBM PC and compatibles allows you to connect your personal computer to an Arcnet token-passing, logical ring network. The board contains the vendor's HYC9058 high-impedance transceiver driver chip, which

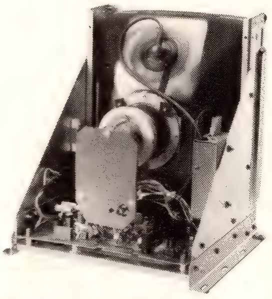
Wells-Gardner takes the *"cuss"* out of customized



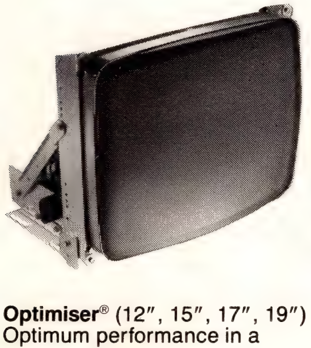
MOD 35™ (15″)
High-density display features up to 35 kHz scanning frequency.



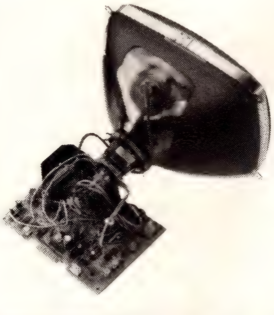
MOD 35™**/MOD 64**™
Landscape version



MOD 64™ (15″, 17″, 19″)
High-density display features up to 70 kHz scanning frequency.



Optimiser® (12″, 15″, 17″, 19″)
Optimum performance in a space-saving package.



Customiser II® (7″, 9″, 12″, 14″)
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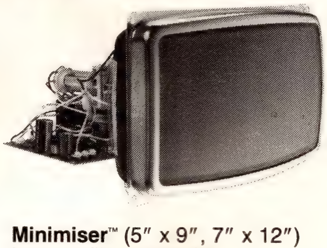

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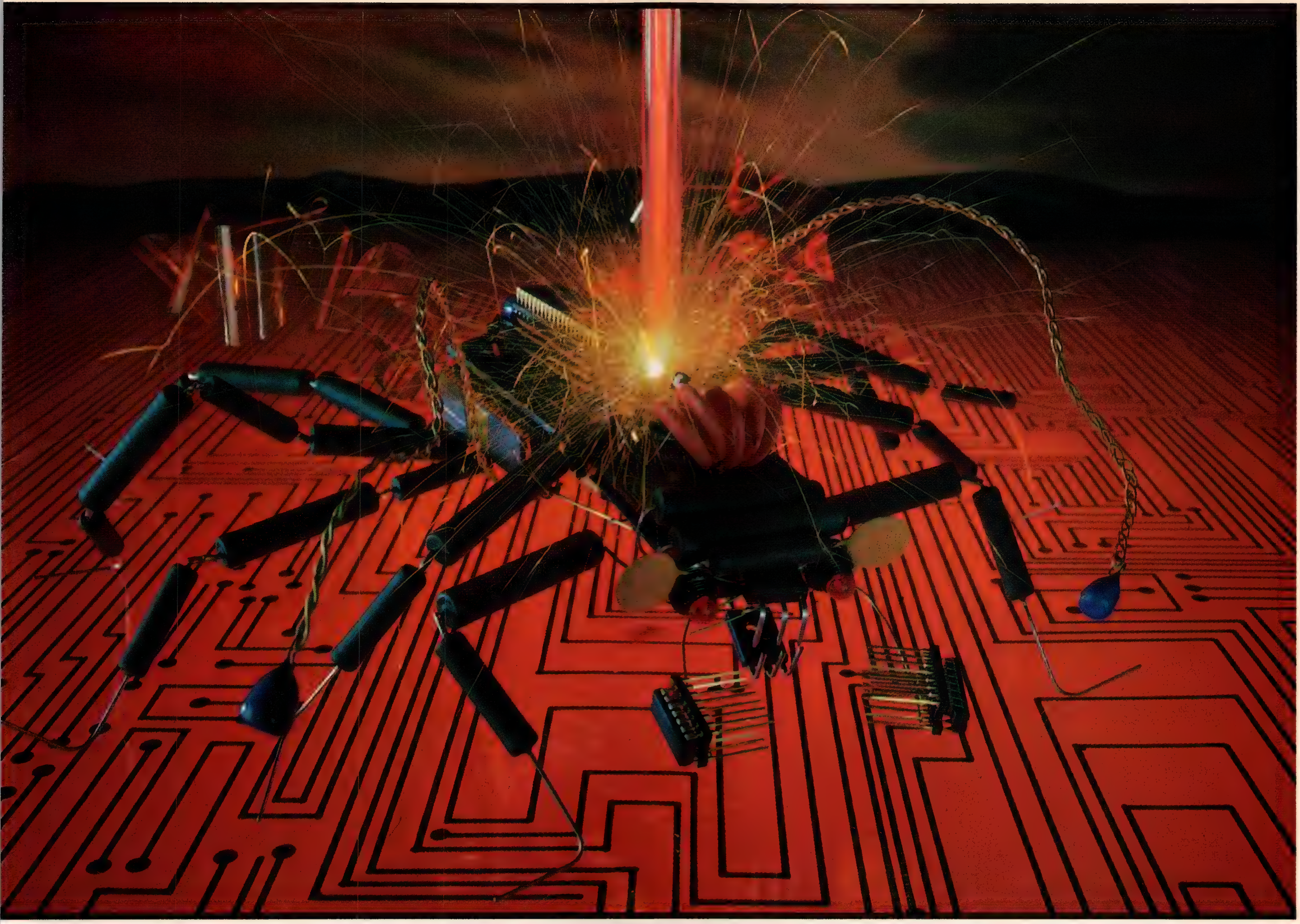

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AFFORDABLE! Intel's Integrated Instrumentation and In-Circuit Emulation System (I^{2}ICE) is not only in stock at Pioneer, it's available at a price that opens up its advantages to more users. For instance, I^{2}ICE is priced as low as $9,995 for 80186, 80188, 8086 and 8088 designs, and $11,995 for 80286 designs. It's far and away the price/performance leader!

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CIRCLE NO 72

What the Japanese taught us about electronic design.

These days, everything is getting packed together tighter than it used to be.

And while the Japanese came up with the Oshiya for packing subways, Racal-Redac came up with an elegantly integrated CAE/CAD system specifically designed for packing electronic designs with things like SMDs, fine line gridless 100% routing, and mounting components on both sides of the board.

It's called Visula.

Unlike other electronic design systems, Visula offers a "connective data structure" that gives you technologically-oriented on-line electrical rule checking. You'll get improved schematics and spend less time in simulation.

Since Visula's design accuracy is a 1/100 of a micron, there's no such thing as an "off grid" component. And, Visula is well suited for ECOs. It automatically updates your schematic when you make changes to your PCB. Logically, not just conventional back annotation.

Visula's user-expandable relational data base, coupled with its fully-integrated 2-D mechanical design program, results in improved manufacturing and test documentation. And Visula does all this naturally, without the workarounds others need.

Today, a lot of companies are saying they've got a "Visula-like" system.

But we can't understand why anyone would buy a "Visula-like" system when they can buy a real Visula.

Call us or write us, so we can show you why anything else is a poor imitation.

Visula's Non-Proprietary Architecture

Platforms:	Apollo, DEC VAX Station II
Operating Systems:	UNIX and VMS
Simulator:	CADAT by HHB Systems
Data Base:	Informix by Relational Database Systems, Inc.

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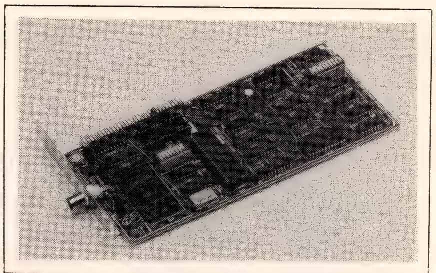

allows you to daisy-chain as many as eight network nodes on one coaxial cable (1250 ft max), thereby decreasing the number of active hubs and the amount of point-to-point wiring required in a network.

The board features a data rate of 2.5M bps, 2k bytes of onboard RAM, and a socket for 8k bytes of PROM. The RAM holds as many as four pages of packet storage to provide double buffering for both receive and transmit functions. Switches let you set the base address of the PROM and data packet buffer to any 64k-byte boundary, and they let you set the I/O base address of the board to any 16-byte boundary. $595.

Standard Microsystems Corp, 35 Marcus Blvd, Hauppauge, NY 11788. Phone (516) 273-3100. TWX 510-227-8898.

Circle No 706

ETHERNET FRONT END

The iSBC 186/530 Ethernet Communications Engine is a front-end processor that provides the message-passing interface of the Multibus II Parallel System Bus. The board combines an 8-MHz 80186 16-bit μP, an 82586 LAN coprocessor, an Ethernet serial interface, an RS-232C port, and a maximum of 512k bytes of onboard dynamic RAM. Four 28-pin sockets accommodate EPROM devices with storage capacities of 64k bytes per device.

The board can relieve the host computer of all tasks required by Ethernet LAN communications; the vendor's proprietary message-passing processor (MPC) manages communications between the front-end processor and one or more host com-

8086 5/8/10MHz
0 WAIT-STATE

The DSB-86/35 operates software written for the Intel iSBC-86/35 up to 35% faster

- Runs existing iSBC-86/35 EPROMS
- 512KB or 1MB Dual-Port RAM, up to 256KB EPROM
- One RS-232C Serial Port and 24-Parallel I/O Lines
- Two iSBX Connectors and an On-Board 8087 Socket
- Two Available Counter/Timers and Nine Vectorable Interrupts

2 Year Warranty, 24-Hour Replacement Policy
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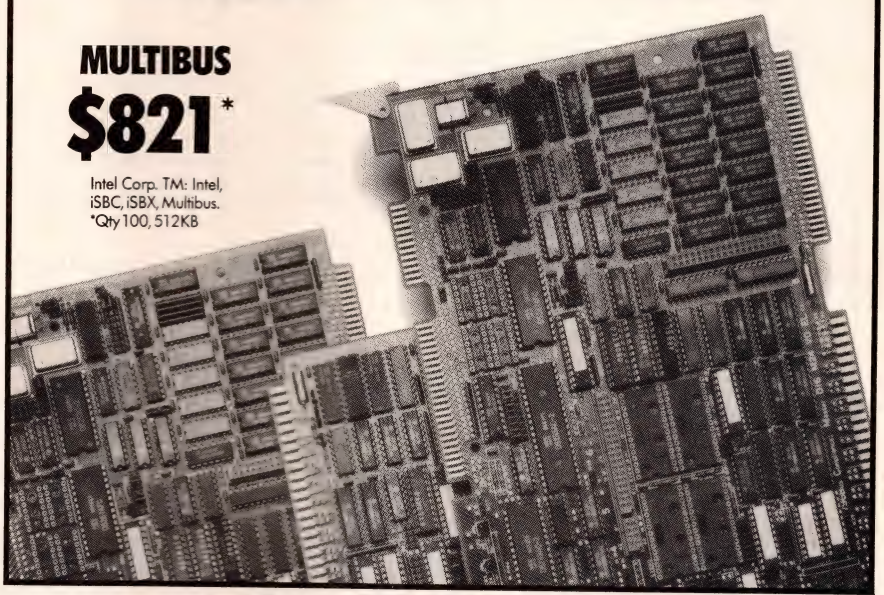
$821*

Intel Corp. TM: Intel, iSBC, iSBX, Multibus.
*Qty 100, 512KB



CIRCLE NO 74

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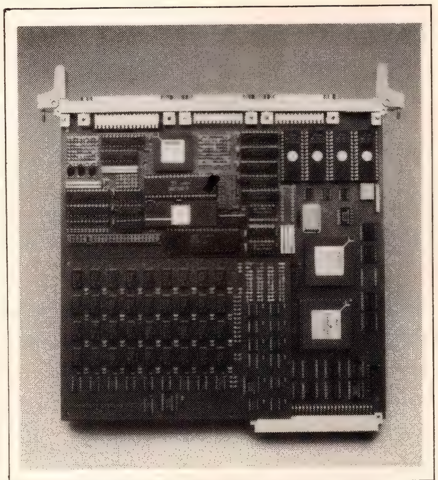


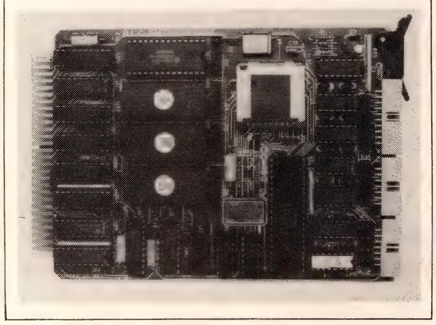
MULTIBUS COMPUTER

The MT68020, a Multibus II single-board computer, is based on the 32-bit 68020 μP and runs at clock rates as high as 16.67 MHz. The board includes either 1M or 2M bytes of onboard, dual-port RAM. In addition, it contains two serial I/O ports, a Centronics printer interface, five counter/timers, and four 28-pin sockets to accommodate as much as 256k bytes of PROM memory.

A message-passing coprocessor provides support for the Multibus II Parallel System Interface. The interrupt structure allows seven interrupt levels and as many as 255 interrupting devices. Options include the MC68851 memory-management unit, which can expand memory-addressing capability to 4G bytes with a minimum page size of 4k bytes; the MC68881 floating-point coprocessor; and the MC68450 4-channel DMA controller. From $2443 (OEM qty).

Microbar Systems Inc, 785 Lucerne Dr, Sunnyvale, CA 94086. Phone (800) 821-1011; in CA, (800) 421-1752.

Circle No 707



5-, 8-MHz CPU CARD

The SCC-188 CPU card for the STD Bus uses the 80188 μP, which offers better performance than the 8088 μP, but maintains upward software compatibility. You can get as much as 256k bytes of memory in any

Save time, money, and board space with our standard ready-to-ship SIMM/SIP.

☐ 4 x 256K
☐ 8 x 256K
☐ 9 x 256K

By putting more memory capacity into smaller areas, Single-In-line Memory Modules (SIMMs) will help you make better use of valuable board space and reduce the overall size and cost of your design.

You can save time and further reduce costs by selecting one of the Interplex standard SIMMs, which are on the shelf and ready to ship. We offer low prices and exceptionally fast delivery on our standard line, comprised of 22-pin 4 x 256K; and 30-pin 8 x 256K and 9 x 256K SIMs and SIPs.

We also offer a complete custom memory module service. We'll design, prototype, and test virtually any type of custom module to meet your specific requirements, and we'll produce it in quantities that are most cost-effective for you. Our custom capability includes working with the new 1-MEGABIT CHIP. We produce 4 x 1-MEG and 9 x 1-MEG modules with seating planes as low as .450.

Interplex standard and custom memory modules feature low-profile design and RFI shielded five-layer PC board construction, which reduces in-circuit noise, enhances module performance, and improves overall electrical characteristics. They are 100% electrically and functionally tested per MIL-STD-883B to insure reliability.

For details, contact Walter Bailey, Interplex Technologies, 381 Park Street, Hackensack, New Jersey 07602. Phone: 201/343-3156; Fax: 201/343-4883; TWX: 710-582-3048.

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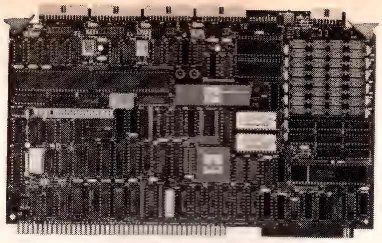
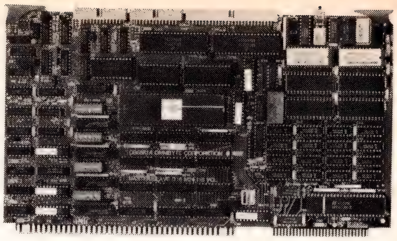


0B68K/MSBC1™ MULTIBUS* SINGLE BOARD COMPUTER

- 12.5MHz 68000 16/32 bit CPU (other speeds and 68010 optional)
- 256K/512K/1M/2M bytes dual-ported; zero-wait-state RAM with parity
- (4) RS-232C serial Synchronous/Asynchronous multiprotocol I/O ports
- (1) iSBX* expansion connector
- (4) 28 pin ROM sockets (up to 256KB)
- Optional memory management
- Omnibyte two year limited warranty

**Multibus and iSBX are trademarks of Intel Corp.*

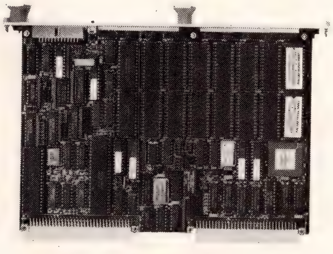
CIRCLE 1



0B68K1A™ MULTIBUS SINGLE BOARD COMPUTER

- 10MHz 68000 16/32 CPU
- 32K/128K/512K bytes zero-wait-state dual-ported RAM
- Up to 192K bytes of EPROM
- (2) RS-232C serial ports
- (2) 16-bit parallel ports
- A triple 16-bit timer/counter
- (7) prioritized-vectored interrupts
- Omnibyte two year limited warranty

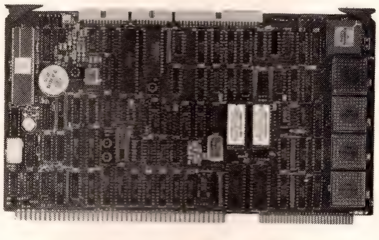
CIRCLE 2



0B68K/VME1™ SINGLE BOARD COMPUTER ON THE VME BUS

- 12.5MHz 68000 16/32 bit CPU
- (8) pairs of 28-pin sockets for RAM and ROM (up to 448K RAM or 896K ROM)
- (2) RS-232C serial ports using (1) 68681 DUART
- (2) 8-bit parallel I/O ports using (1) 68230 PI/T
- System controller functions are supported
- (7) Prioritized bus or auto vectored prioritized interrupts
- Omnibyte two year limited warranty

CIRCLE 3

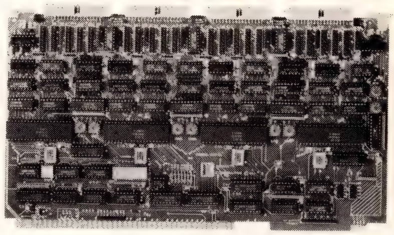


0B68K/MMU™ MULTIBUS CPU BOARD WITH OPTIONAL MEMORY MANAGEMENT

- 10MHz 68010 16/32 bit CPU
- Up to (4) 68451 Memory Management Units (optional)
- High speed iLBX* memory port
- 8 channel DMA port
- (2) RS-232C serial ports
- 4K/16K bytes of RAM
- (2) 28-pin ROM sockets
- Omnibyte two year limited warranty

**iLBX is a trademark of Intel Corp.*

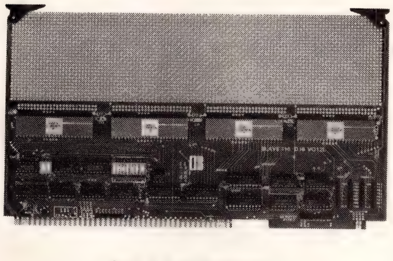
CIRCLE 4



0B68K/OCTAL™ MULTIBUS SERIAL I/O BOARD

- (8) RS-232C or RS-422 serial I/O ports
- Individually programmable baud rates between 50 and 38.4K baud
- (4) 68681 DUART chips
- (4) Multi-function programmable 16-bit counter/timers
- Omnibyte two year limited warranty

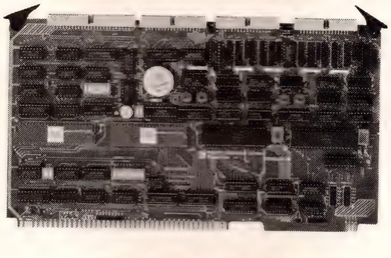
CIRCLE 5



0B68K230™ MULTIBUS 96-BIT PARALLEL I/O TIMER BOARD

- 96 bits of software definable parallel I/O
- (4) 68230 PI/T chips
- (4) 24 bit timers
- 35 sq. in. of prototyping area
- Omnibyte two year limited warranty

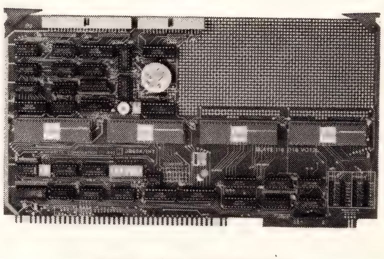
CIRCLE 6



0B68K/INT(S)™ MULTIBUS HOST ADAPTER/ SERIAL I/O BOARD

- (2) 68230 PI/T chips
- (2) 68681 DUART chips
- (4) RS-232C or RS-422 serial I/O ports
- SASI interface to disk controller
- Parallel printer port
- Real time calendar clock with battery back-up
- Omnibyte two year limited warranty

CIRCLE 7



0B68K/INT(P)™ MULTIBUS HOST ADAPTER/ PARALLEL I/O BOARD

- 48 bits of software definable parallel I/O
- Real time calendar clock w/battery back-up
- (4) 68230 PI/T chips
- 15 sq. in. of prototyping area
- Parallel printer port
- SASI* interface to disk controller
- Omnibyte two year limited warranty

**SASI is a trademark of Shugart Associates.*

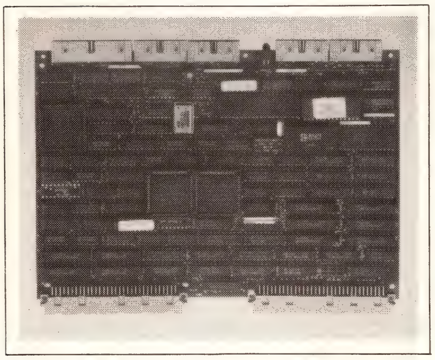
CIRCLE 8

combination of RAM, EPROM, EEPROM, or battery-backed RAM. And you can increase total memory to 1M byte by including an extra memory card in your system.

The CPU card includes the 82530 serial I/O chip, which provides two communications channels and a 1.2M-bps transfer rate; onboard drivers provide full RS-232C modem control on channel A and RS-232C or RS-422 modem control on channel B. You can configure the channels independently for either DTE or DCE. Other features include three 16-bit counter/timers, a 2-channel DMA controller, a programmable interrupt controller, and a real-time calendar clock. A firmware monitor/debugger is optional. The 5-MHz version, $549; the 8-MHz version, $595.

RLC Enterprises, 1117 Hill View Dr, Milpitas, CA 95035. Phone (408) 946-7471.

Circle No 709



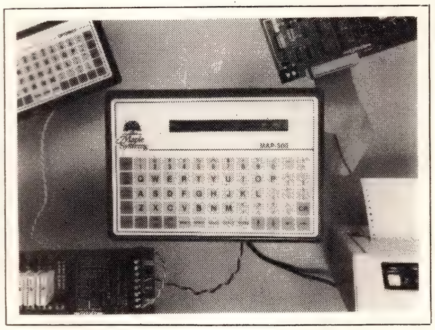
VME/ESDI CONTROLLER

The Model 712 VME Bus/ESDI disk controller provides an intelligent interface between a host computer using the VME Bus and as many as four disk drives using the ESDI interface. The controller yields data-transfer rates as high as 1.2M bytes/sec. An enhanced DMA channel yields transfer rates as high as 10M bytes/sec via a pipelined architecture implemented in two custom VLSI chips.

Other features include a 2k-byte command buffer for queuing commands, an 8k-byte FIFO buffer for data transfers, a command optimization scheme, and a custom gate array that implements a 48-bit error-correction algorithm. Programmable interrupt levels, interrupt vectors, and address modifiers, together with an I/O register protocol, allow multiple processors to access the controller. In addition, the vendor has developed, in conjunction with several supermicrocomputer suppliers, an intelligent software interface that makes the controller particularly suited to systems that run the latest versions of Unix and Unix-like operating systems. $1295 (1000). Delivery, 60 to 90 days ARO.

Xylogics Inc, 144 Middlesex Tpk, Burlington, MA 01803. Phone (617) 272-8140.

Circle No 710



PROCESS CONTROLLER

The MAP590B, an industrial process controller based on an MC6809 μP running at 4 MHz, has a cast-aluminum housing that protects against hostile environments. It operates over 0 to 50°C and at 95% relative humidity (noncondensing).

The keyboard comprises 65 membrane switches arranged in 5 rows of 13 keys each. In addition to ASCII-character keys (arranged in QWERTY order), the keyboard has 10 control keys and six user-definable function keys. Its LCD display provides two lines of 40 characters each; backlighting is optional.

Four 28-pin sockets can accommodate memory chips of 2k to 32k bytes for a total RAM or ROM of 60k bytes. One socket normally ac-

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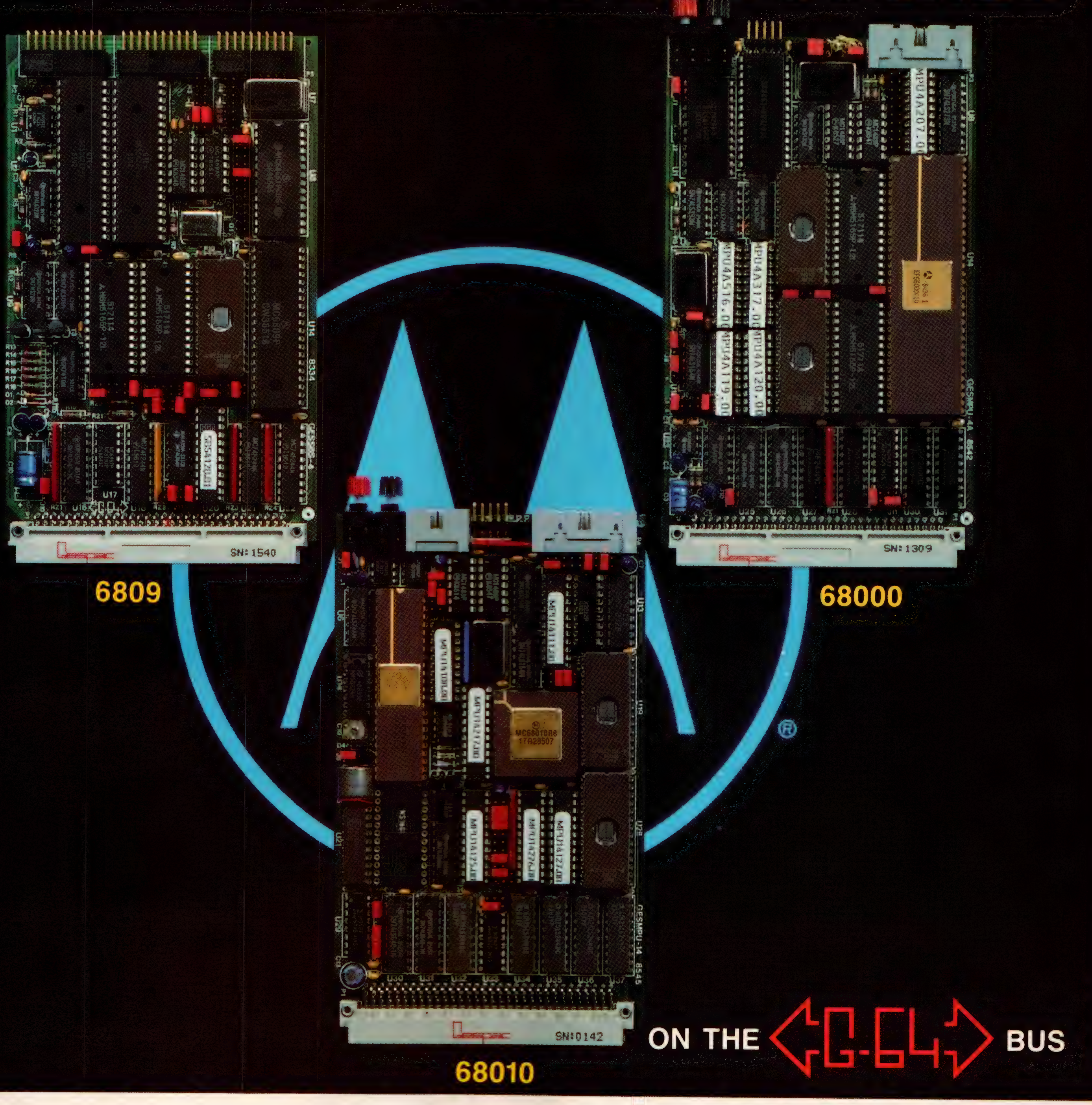

ESSBS-4 $316*

Hz 6809 CPU
kets for up to 32 Kbytes EPROM
kets for up to 16 Kbytes CMOS RAM
RS 232 serial port
TTL Bidirectional I/O lines
16-bit timers

GESMPU-14 $636*

8 MHz 68010 CPU
Optional 32081 arithmetic unit
Sockets for up to 128 Kbytes EPROM
One RS 232 serial port
4 x 8-bit timers
Real-time clock/calendar and battery

GESMPU-4A $316*

8 MHz 68000 CPU
Sockets for up to 128 Kbytes EPROM
Sockets for up to 64 Kbytes CMOS RAM
One RS 232 serial port
Three 16-bit timers

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Nice enough, but there's more.

Like the 68020 with MMU, DMA and Floating Point capabilities. RAM, from 1MB to more than 4MB—all high-speed with dual-ported access. Two serial ports and a parallel port. We also provide UNIX™ System V and real-time operating systems ported to the CPU.

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CIRCLE NO 78

commodates a ROM-resident Basic interpreter enhanced with special process-control commands. Two serial ports (RS-232C or RS-422) provide software-selectable data-transfer rates to 19.2k bps. Built-in analog input circuitry provides as many as eight channels and 8-bit resolution; DIP headers allow scaling for larger inputs. The controller also has 24 parallel input and 24 parallel output lines, a calendar clock, and an expansion connector for installation of extra peripherals. $950.

Maple Systems Inc, 2615 W Casino Rd, Everett, WA 98204. Phone (206) 347-1292.

Circle No 711

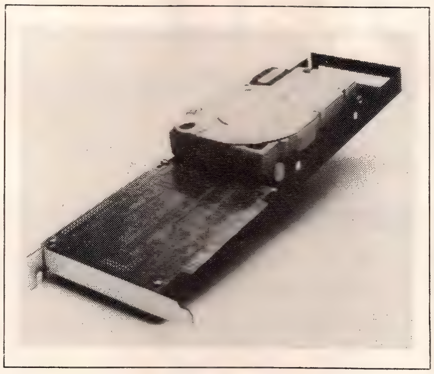
IEEE-488 INTERFACE

The DIO-2000 digital interface unit lets you connect any combination of 80 digital I/O signals to an IEEE-488 system. The unit has two independent I/O ports, each of which can handle as many as 40 channels. You can configure 32 of these channels for either input or output at TTL signal levels; the remaining eight channels handle voltages to 36V and sink currents to ¼A.

You can expand the unit's I/O capabilities by connecting a DIO-2010 expansion unit to each of the DIO-2000's ports; the expansion unit can sit on top of the interface unit and contains a power supply for two plug-in modules, each of which contributes 32 more digital channels. DIO-2000, $795; DIO-2010, $549.

Erbtec Engineering Inc, 2760 29th St, Boulder, CO 80301. (303) 447-8750.

Circle No 712



PLUG-IN DISK DRIVE

The BusinessCard 21, a combined Winchester disk drive and controller, has a formatted capacity of 21.3M bytes and plugs into an expansion slot in any IBM PC, PC/XT, or compatible computer. The unit doesn't require any accessory boards, cables, or installation software. Compatible with PC-DOS and MS-DOS (2.0 and higher), it consumes 11W. The drive has a head-landing zone outside the data area of the platters; you can use any utility that includes a landing routine to move the heads to the landing zone before turning off the power.

Tandon Corp, 20320 Prairie St, Chatsworth, CA 91311. Phone (818) 993-6644. TWX 910-493-5965.

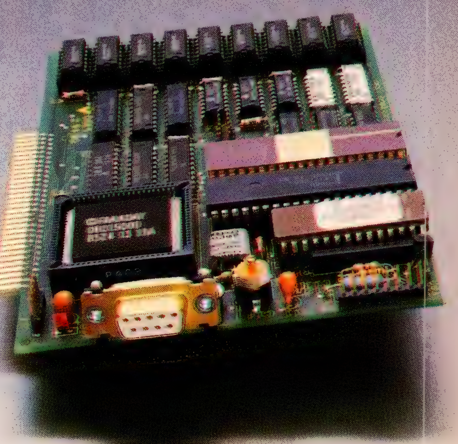
Circle No 714

VME BUS CPU

The CPU-2PB (piggyback) processor board for the VME Bus offers the choice of a 68000 or 68010 μP running at 12.5 MHz, 512k bytes of dual-port RAM, two sockets for 128k bytes (max) of EPROM, an optional 68881 floating-point math coprocessor, and an optional 68450 4-channel DMA controller. Two channels provide functions for using the CPU board; the remaining two channels provide functions for using a piggyback I/O board, which mounts on the CPU board and which the vendor can configure according to your needs.

The vendor's first piggyback I/O board is the PBSCSI1 SCSI/serial interface. This unit features the NCR 5385/5386 SCSI controller

smallest



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Faraday Electronics, 749 North Mary Avenue, Sunnyvale, California 94086, TLX 706738. In England, TLX 847096 EMDAL.

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BULLETIN:

SEMICUSTOM SOLUTIONS

Advances in system simulation yield substantially increased success rates in ASIC design.

FACT: Semicustom IC vendors report a 97–99% success rate for gate arrays, yet only 33% actually work when first tested in the system. Daisy's complete simulation environment improves design control and success rates two ways: First, array resimulation incorporating circuit timing modifications due to physical layout. Second, system level simulation where the array is simulated in the context of the target system. RESULTS: Substantially increased gate array and system design success rates.

Automatic gate array layout workstation reduces risk. Designers control costs, schedules, and ASIC performance.

Workstation-based layout on Daisy's MegaGATEMASTER™ gives the designer maximum control for better net routing and increased array utilization. Automatic, in-house layout reduces risk by avoiding vendor queues and reducing or eliminating iterations, assuring the designer of ASICs that are on time, on budget, and perform to specification when used in the final system.

CDI, NEC, RCA, add design-through-layout kits to the GATEMASTER™ Library.

California Devices, Inc.® NEC Electronics Inc.® and RCA® have each introduced automatic gate array layout design kits for the MegaGATEMASTER. Now eight ASIC vendors support physical layout on the MegaGATEMASTER, in addition to the over 55 vendors who support electrical design and simulation on Daisy workstations—and the list is growing. Designers can select from a wide "portfolio" of ASIC vendor capabilities, gate counts and technologies.

MegaFAULT: ASIC "Manufacturability Insurance."

MegaFAULT,™ Daisy's new high speed fault simulator provides the engineer with the highest confidence level in working, manufacturable silicon through reliable fault grading of test patterns required to detect potential manufacturing defects. MegaFAULT is fully integrated with Daisy design and verification tools and provides full support of ECL, CMOS, and other circuit technologies, and can also be used for fault simulations of board-level designs.

Daisy Literature Line:
1-800-556-6661
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Department D42.

For information on Daisy's growing Semicustom Design Solutions, and the Daisy product line, call the Daisy Literature Line at 1-800-556-6661 (in California, 1-800-824-2385) Department D42, or write the Daisy Literature Line, 3606 W. Bayshore Rd., Palo Alto, California, 94303.

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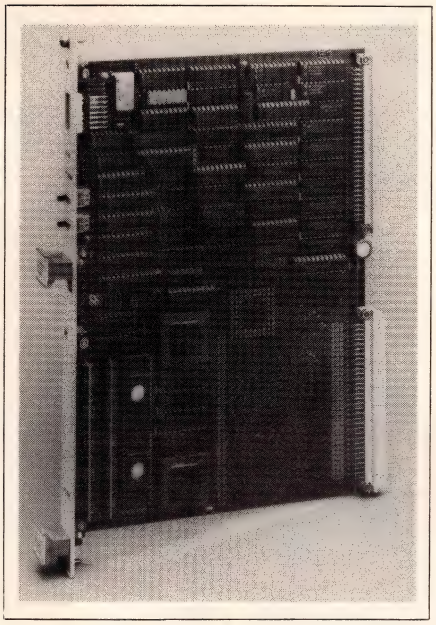
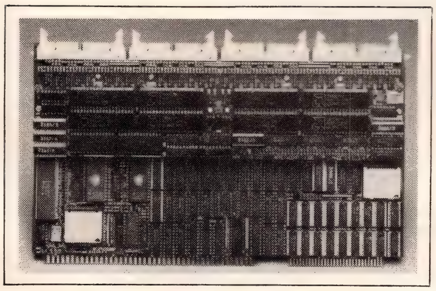
Computers and Peripherals



chip, which operates in both initiator and target modes. You can set the 3-bit SCSI Bus ID code via jumpers. The SCSI Bus drivers/receivers allow a maximum cable length of 6m. The serial interface uses the 68581 DUART chip to provide two independent serial channels between the CPU-2PB and peripherals; these channels yield data-transfer rates to 38.4k bps over the serial link. CPU-2PB, $1945; PBSCSI1, $455.

Electronic Modular Systems Inc, 4546 Beltway, Dallas, TX 75244. Phone (214) 392-3473.

Circle No 713



I/O PROCESSOR

The TIO-2000 Server is a 16-channel I/O processor for Multibus systems. The board manages all character-interrupt processing and data-flow control for 16 (max) remote terminals. Each channel has a 1k-byte input buffer and a 1k-byte output buffer. The input buffer stores incoming characters from a terminal until it receives a new-line character; then the complete line passes to the host computer. Likewise, the output buffer stores 1k-byte blocks of data originating in the host and then retransmits them to the appropriate terminal.

The board implements the general terminal interface functions defined by Unix System V, Line Discipline 0. Every channel has an RS-232C interface capable of transferring data at speeds as fast as 19.2k bps. You can configure each interface for hardware flow control (RTS, CTS) or software flow control (X-On, X-Off) and, via jumpers, you can select each line to act as either DTE or DCE. $1995 (100).

Metacomp, 9466 Black Mountain Rd, San Diego, CA 92126. Phone (619) 578-9840.

Circle No 715

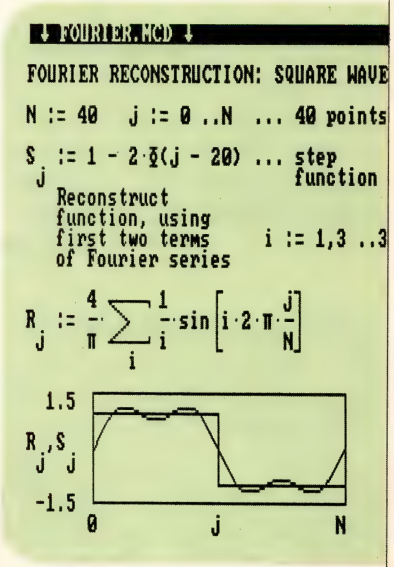
GRAPHICS COPIER

CH-5300 Series intelligent color-graphics copiers produce A- and B-size images on plain paper and transparency film. Model CH-5301 (A-size image only) has a print resolution of 152 dots/in. and a print time per copy of less than 40 sec. Model CH-5312 (A- and B-size images) has a print resolution of 203 dots/in. and a print time of less than 2 minutes for a B-size image.

You can choose from various parallel and video interfaces. One video interface provides 3.75M bits of memory and yields a resolution of 1280×1024 pixels; another has 15M bits of memory and a resolution of

MathCAD

The Engineer's Scratch Pad



↓ FOURIER.MCD ↓

FOURIER RECONSTRUCTION: SQUARE WAVE

$N := 40$ $j := 0 ..N$ ... 40 points

$S_j := 1 - 2\cdot\Phi(j - 20)$ ... step function

Reconstruct function, using first two terms of Fourier series $i := 1,3 ..3$

$R_j := \frac{4}{\pi}\sum_i \frac{1}{i}\cdot\sin\left[i\cdot 2\cdot\pi\cdot\frac{j}{N}\right]$

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2560×2048 pixels. The intelligent video interfaces accept RGB signals from the display generator; thus, you don't need extra software. Model CH-5301, from $5995; Model CH-5312, from $9995. Delivery, 90 days ARO.

Seiko Instruments USA Inc, Graphic Devices and Systems Div, 1623 Buckeye Dr, Milpitas, CA 95035. Phone (408) 943-9100.

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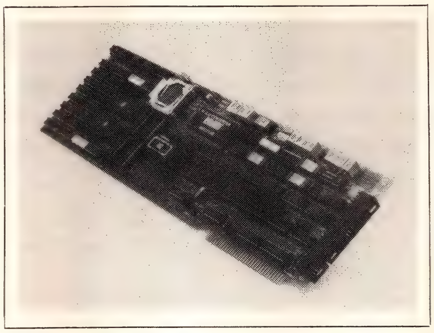
ANALOG PROCESSOR

The Data Acquisition Processor plugs into a full-size expansion slot of an IBM PC or compatible and comprises a 16-channel analog input section, 128k bytes of onboard memory, and an 80186 μP. A/D-conversion rate is 57 μsec/sample; two S/H circuits yield one cycle of settling time. The software can select independent gains of 1, 2, 4, 8, 16, 32, 64, or 128 for each channel.



A ROM-resident, real-time operating system handles all low-level processes relating to data acquisition, memory allocation, data buffering, and interprocess communication; processes communicate with each other through buffers in the onboard memory. The firmware includes predefined processes such as averaging, peak extraction, and FFTs. You specify which processes the 80186 is to perform by downloading a command file written in the vendor's high-level data-acquisition processing language. Once processing is complete, the board transfers the results to the host PC via a DMA channel. $2500.

Microstar Laboratories Inc, 2863 152nd Ave NE, Redmond, WA 98052. Phone (206) 881-4286.

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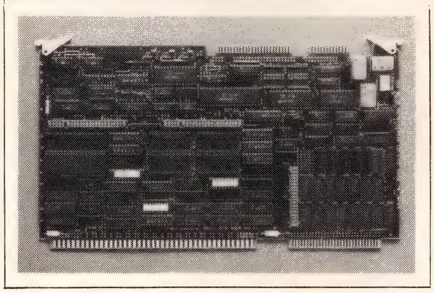

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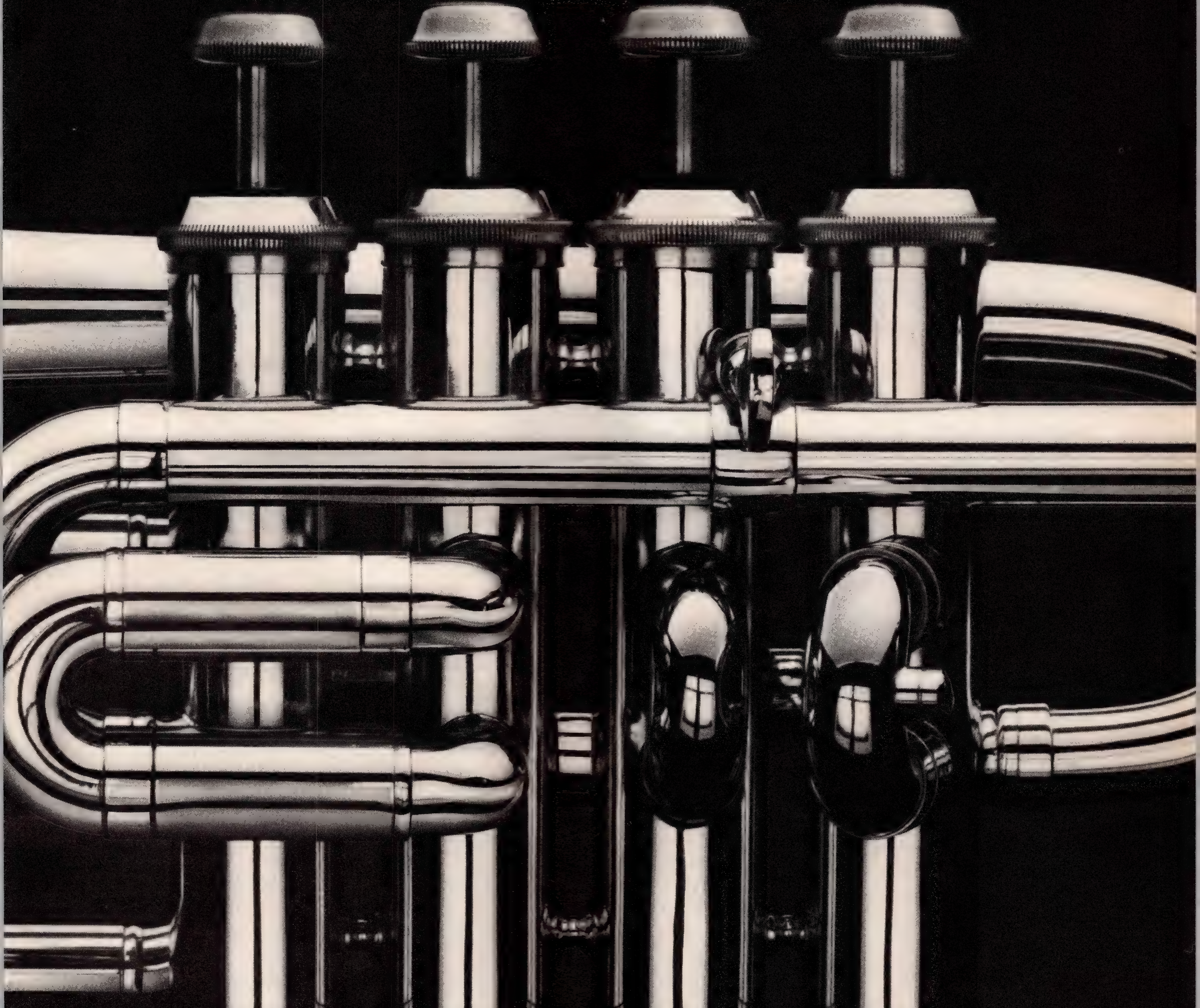

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CIRCLE NO 83

up with the CPU, and because the CPU can access the entire address space without any delays caused by accessing off-board memory through the Multibus, the 8086 operates at maximum efficiency. Other Multibus masters, as well as the onboard CPU, can access all of the memory.

The board has four sockets that can accommodate as much as 256k bytes of EPROM. I/O facilities constitute one RS-232C interface and 24 programmable parallel I/O lines. Interrupt facilities provide one nonmaskable interrupt and eight vectored interrupt levels, expandable to 64 levels by cascading additional 8259 PIC chips. 512k-byte-RAM model, $821 (100).

Densan Div, Pascot Inc, 17981 Skypark Circle, Suite B, Irvine, CA 92714. Phone (714) 261-5220.

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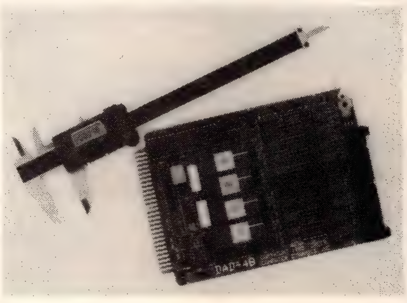

STD BUS ANALOG CARD

The DAD-48 is a multifunction analog I/O board for the STD Bus. The card offers eight analog input channels with 16-bit resolution, and four analog output channels with jumper-selectable capabilities for providing 0- to 20-mA current sink and ±10, ±5, ±2.5, 0 to 5, or 0 to 10V outputs. Eight instrumentation amplifiers let you adjust the gain and offset for each channel.

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Computer Dynamics Inc, 105 S Main St, Greer, SC 29651. Phone (803) 877-7471.

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GRAPHICS TABLET

The GT1510 graphics tablet provides a 10×15-in. nonreflective working surface for creating drawings and graphics with an IBM PC or compatible computer. The tablet comes with a pen for freehand drawing and a cursor (with lens and cross hairs). Switch-selectable modes include point, stream, and switch-stream mode. The tablet has

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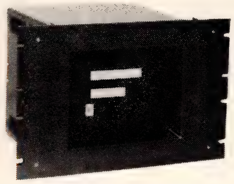
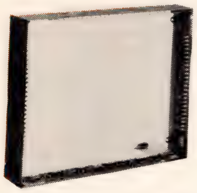


Rack-mount TID



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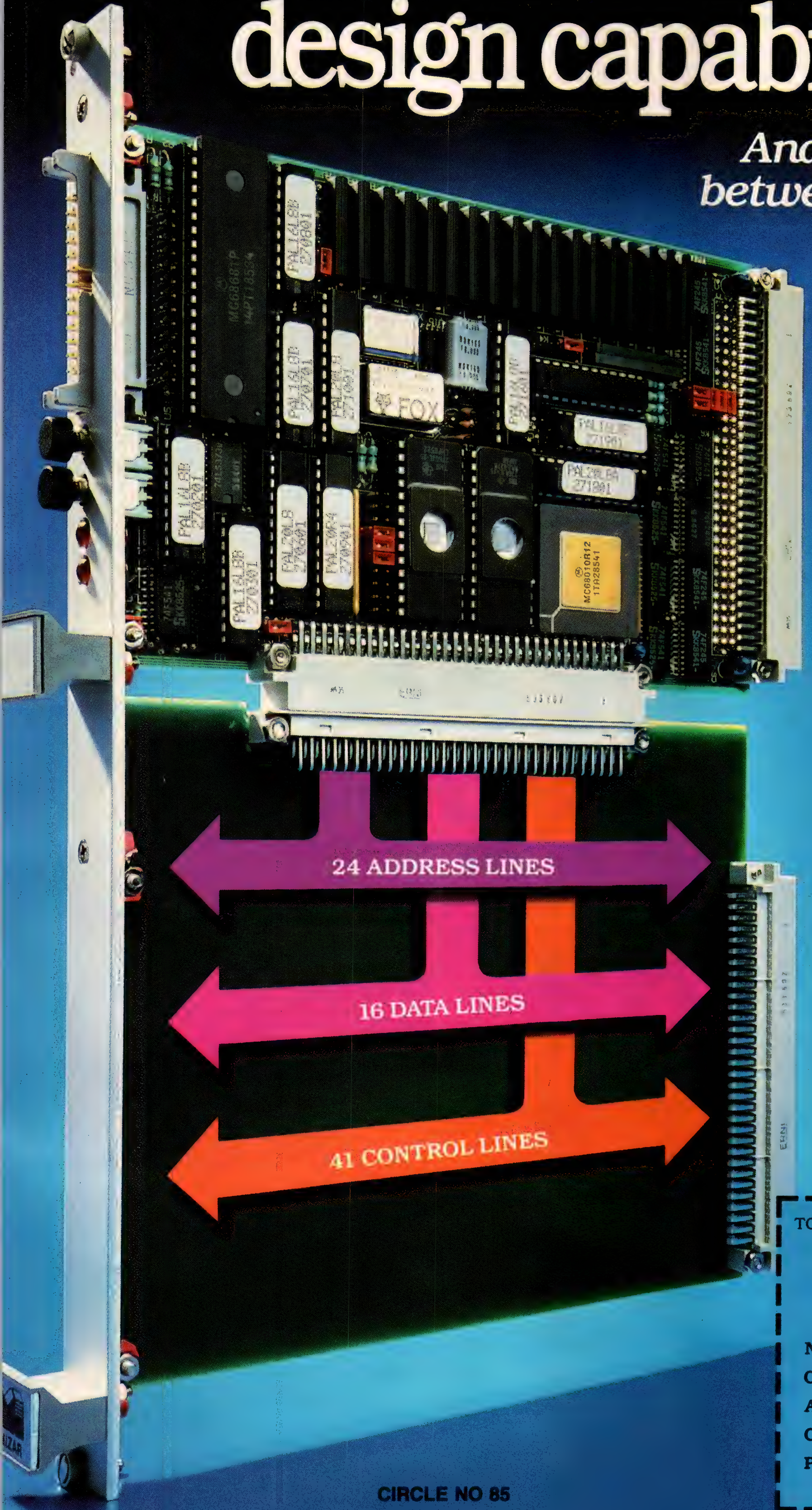

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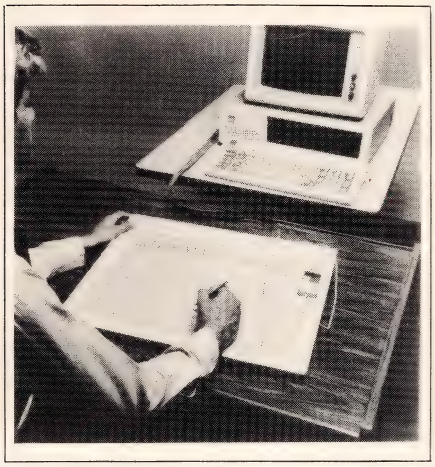

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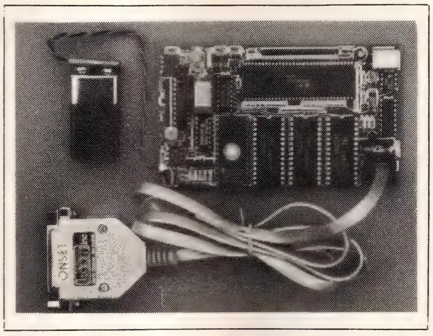

DATA LOGGER

The Tattletale Model III data logger provides eight 8-bit analog input channels and 14 programmable I/O lines. Input data resides in 64k bytes of onboard static CMOS RAM. The data logger executes PROM-resident programs written in TTBasic, a dialect of Basic that includes commands that facilitate data acquisition and process control. Transfer of the stored data to the host computer occurs over an RS-232C link at speeds reaching 9600 bps; you can use either TTBasic commands or the Xmodem protocol to control transfers.

The logger draws only 100 μA in its dormant mode and can perform as many as 100 measurements/sec. The 2.9×5×0.8-in. board runs from a 9V battery and operates over 0 to 70°C. $895. Delivery, six weeks ARO.

Onset Computer Corp, Box 1030, North Falmouth, MA 02556. Phone (617) 563-2267. TLX 469915.

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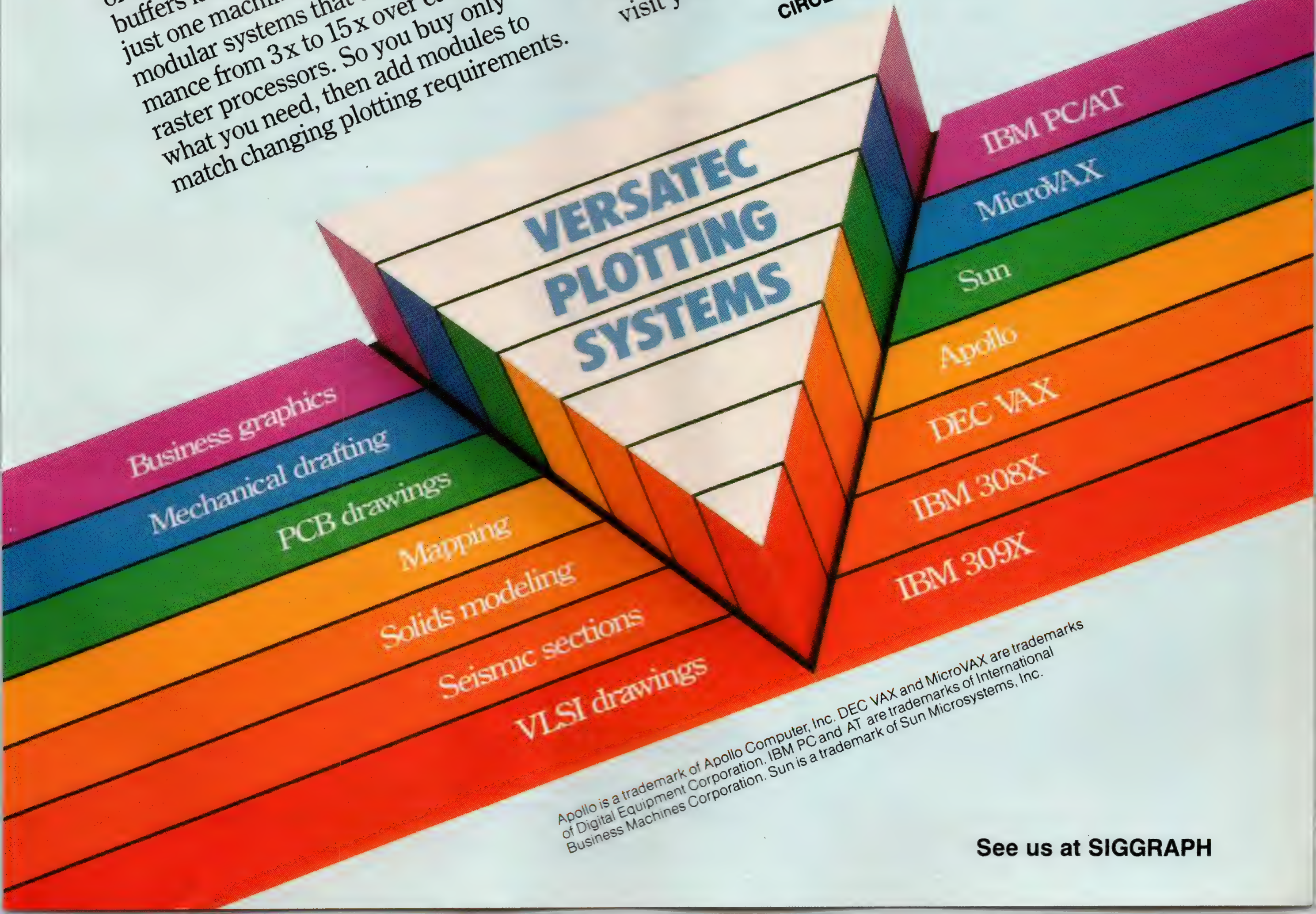

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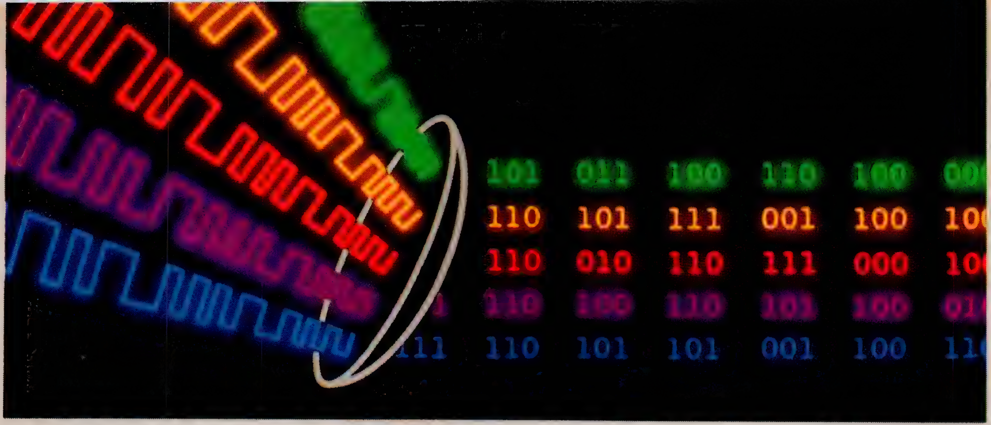

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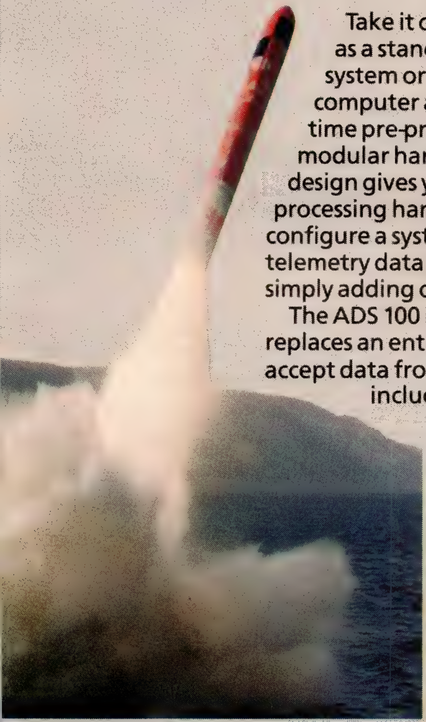

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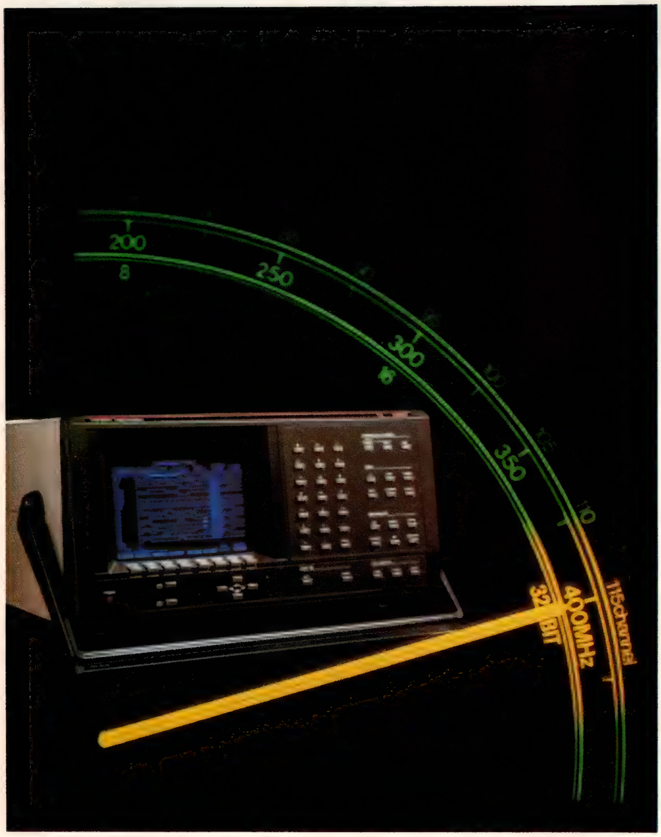
CIRCLE NO 89

Timing analyzers keep pace with high-speed logic

You can choose from a range of fast timing logic analyzers to debug today's complex, high-speed logic circuits. Several logic analyzers let you view your circuit's logic timing with 2.5-nsec resolution, and two analyzers actually provide subnanosecond resolution.



400-MHz transitional timing logic analyzer *(Philips Test & Measuring Instruments)*

Modern timing logic analyzers let you capture timing sequences occurring even in very fast and complex circuits, such as those based on ECL devices or 32-bit µPs. Instrument manufacturers are continuing to improve upon the logic analyzers they offer; they're building faster analyzers with more data channels and deeper memories than ever before. Several analyzers offer sampling speeds of 400M samples/sec, and one even provides 2G samples/sec. Many analyzers offer eight or more data channels for timing, and some provide 2k, 4k, and even 8k bits of memory per channel.

Timing logic analyzers, which were developed in the 1970s, still provide the only effective and efficient means of capturing timing information in a digital system. An analyzer both lets you view the signal activity taking place at one time at a number of different points within your system and lets you measure the time between logic events.

Other instruments, such as timer/counters and oscilloscopes, just don't satisfy the need for timing logic analysis in digital systems. For example, although timer/counters provide much higher timing resolution and accuracy than does a logic analyzer, timer/counters are difficult to arm and trigger when you're making a time-interval measurement between two logic events, and they don't let you view logic events.

Chris Everett, *Regional Editor*

And although oscilloscopes let you see logic events, most scopes don't have the sophisticated triggering mechanism you need in order to view specific logic events. Even the few oscilloscopes that do have the triggering capabilities of a logic analyzer can't capture data over more than two or four data paths at one time. Analog scopes (both real-time and storage types) can catch only post-trigger data (data that occurs after the trigger point). Often, however, you need to observe logic events that occur before the trigger event. A timing analyzer lets you look at logic activity over a large number of data paths either before or after a trigger event.

When you consider the specs for logic analyzers, note that the expression "a 100-MHz logic analyzer" does not mean that the logic analyzer can process and display 100-MHz signals. A 100-MHz logic analyzer is an analyzer that samples at 100M samples/sec. This sampling rate is a crucial spec for a logic analyzer, because you often use an analyzer to capture single-shot events instead of repeated events. You can't accurately reconstruct a single-shot event by sampling data at two times the maximum signal rate. Instead, to obtain ±10% timing resolution, you need to sample data at 10 times the maximum signal rate.

In other words, you should use a 100-MHz timing analyzer to view 10-MHz logic. At 100 MHz, the timing analyzer provides 10-nsec timing resolution and collects at least 10 data points for each pulse. This rate is adequate for catching and displaying most of the logic activity in your 10-MHz system except for race conditions or line-contention conditions.

Further, note that data sheets don't normally list the operating speed of a logic analyzer's triggering circuitry, so when you're considering an analyzer, be sure to ask the manufacturer for that spec. In most analyzers, the triggering circuitry doesn't operate as fast as the sampling circuitry does. When it's looking for the first trigger word or event, the trigger circuitry can usually keep up with the rest of the data-acquisition circuitry. However, after the trigger circuitry detects the first event, it must reset itself before looking for the next event. Reset times on the order of tens of nanoseconds are not uncommon. If a trigger condition occurs during the reset time, the trigger circuitry may miss the condition. In general, you should look for an analyzer whose triggering time is a little faster than the speed of the system under test.

416 200-MHz data-acquisition channels housed in four mainframes and controlled by a color terminal *(Tektronix)*

Many timing logic analyzers employ innovative circuit techniques and high-speed memory and logic components to provide the sampling rates that you need for debugging high-speed logic circuits. The 64300 analyzer from Dolch Logic Instruments, for example, uses a time-multiplexing technique. This technique divides the analyzer's 64 channels into four blocks of 16 channels each. Three of the four 16-channel blocks have maximum sampling rates of 25 MHz each. By tying the inputs of two of the 16-channel blocks together and letting each block sample the data alternately, the manufacturer gives the analyzer an effective sample rate of 50 MHz. Further, because the two blocks are time multiplexed, the memory behind the resulting 16 channels is doubled to 2k bits/channel.

The analyzer also catches short glitches. Most engineers define a glitch as any unwanted signal or spike, of any size, that occurs in a system. To a logic-analyzer vendor, however, a glitch is any signal that's shorter than the analyzer's sample period. In other words, a glitch is any even number of signal transitions between two of the logic analyzer's sample points (a short high or low pulse that occurs between two sample points).

When a data sheet specifies that a logic analyzer has glitch-capture circuitry, therefore, it's referring to the analyzer's ability to catch short glitches. Any logic analyzer can detect and display long glitches (longer

Timing logic analyzers still provide the only effective and efficient means of capturing timing information in a digital system.

than the sampling period of the logic analyzer), but short glitches (those less than one sample period wide) can go undetected by analyzers that don't provide this special glitch-capture circuitry.

Because the A/D converters in logic analyzers are not fast enough to capture short glitches, many logic analyzers have other circuitry for this purpose: They employ latches on the inputs to detect and store any short glitches.

Be aware that different analyzers often use different methods of storing captured glitch data, however, and these storage methods may affect your choice of a logic analyzer. Any one of Gould's K450 series of logic analyzers, for instance, stores the glitch data in its memory by causing the logic state at the time of the next sample point to switch to the opposite level for one period and then switch back to its original state. The K450 Series is a family of 16-, 32-, and 48-channel analyzers that sample data at 200 MHz across all channels.

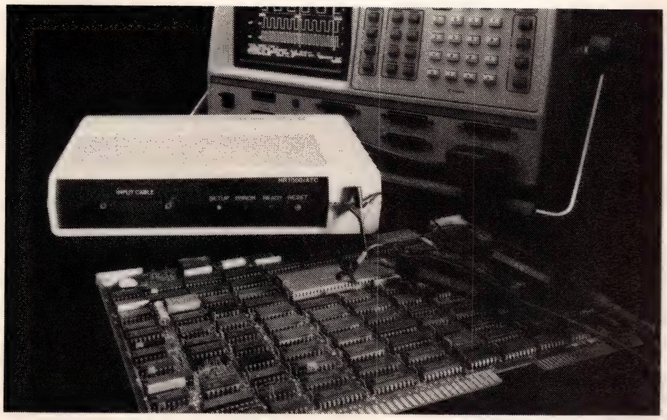
You can call up the glitch-capture mode any time the K450 samples data at ≤100M samples/sec. If you're operating a K450 analyzer at 100 MHz (10-nsec sampling period) and it detects a 5-nsec glitch, the K450 will display the glitch as a 10-nsec pulse. Remember that your analyzer samples data five to 10 times faster than your system's maximum data rate. Therefore, any data that's at least five to 10 sample periods long must be valid data. Any shorter pulse that the analyzer displays must be a glitch.

Second glitch memory

This technique of storing glitches in the analyzer's main memory does have a flaw: The logic analyzer doesn't display any glitch that occurs just before a valid logic-level transition takes place. To overcome this limitation, some analyzers store the captured glitches in a second memory. After the data capture is complete, the analyzer merges and displays the two sets of data. Hewlett-Packard's 1630/31 logic analyzers use this 2-memory method of storing glitch information. Because the 1630/31 instruments store the glitch information in a second memory, they can also highlight the glitches on the screen.

Hewlett-Packard provides this second memory without adding memory chips. Instead, the company borrows the analyzer's main acquisition memory from adjacent channels. Kontron employs the same technique in its Series III logic analyzers. When you switch on these analyzers' glitch-capture mode, you give up half the machines' data-acquisition channels. In contrast, when you use the glitch-capture circuitry in one

Modular state/timing logic analyzer with 48-channel/100-MHz module *(Dolch Logic Instruments)*



200-MHz logic analyzer with time-interval-averaging measurement probe *(Gould Inc)*

of Tektronix's analyzers, you give up half of each channel's memory depth.

With an 8-channel, 100-MHz timing option, Rohde & Schwarz's System LAS logic analyzer offers both glitch-detection schemes: The latch mode gives you glitch detection on all eight channels; the glitch mode uses the memories from four of its channels to hold glitch data for the other four channels. You can expand the System LAS to include 24 timing channels operating to 100 MHz, or you can add an optional 8 channels at 400 MHz.

In sum, you face a tradeoff when using either storage method: If your analyzer stores glitch data in its main memory, you have full use of all your measurement channels, but the machine may miss glitches that occur near a valid signal transition, and you must find the glitches in the display without help from the analyzer. If your analyzer stores glitch data in a second memory, it will help you spot all the captured glitches, including those occurring next to a signal transition. However, in some of the analyzers, only half the probes can catch glitches, so you have to be sure to connect the correct probes to the parts of the circuit where you expect to find glitches. You may have to swap probes to connect the right analyzer channels to the right points in your circuit.

Although glitch-capture circuitry is useful for detecting short glitches on a single data channel, you can't use it to resolve high-speed timing events that occur over two different channels. To resolve such events, you'll need an analyzer that samples at a faster rate. The faster the sampling time, however, the smaller the window you can store. Dolch's 64300, which offers 16 channels and 300M samples/sec, limits you to viewing data through a 1.7-μsec window. When you use Philips' PM 3551 with its optional 4-channel, 300-MHz board, you're limited to a 0.85-μsec window.

To increase these window sizes, some companies give you the option of adding more high-speed memory and other circuitry, but this extra circuitry can be expensive. Gould tacks a 2k-bit/channel memory behind its K500-D 500-MHz acquisition circuitry to increase the analyzer's window to 4.1 μsec. The 8-channel analyzer costs $17,500.

Kontron also uses 2k bits of memory behind each of its eight channels on its 500M-sample/sec acquisition card and 8k bits/channel on its 50-MHz cards. When you switch the Series III analyzer to the interlaced mode, in which it operates at 100M samples/sec, you halve the number of measurement channels, but double the acquisition memory behind the remaining channels.

Tektronix stacks 4k bits of memory behind each channel on the optional 200-MHz acquisition card for its DAS 9200 logic analyzer. You can put as many as six of these 16-channel cards together with the DAS 9200's application bus, which is a set of 156 undedicated lines that link adjacent cards. The cards form a module that operates as if it were a single 96-channel instrument. Whether you use just one card or all six, the module functions without degradation of its specs. You can use

Text continued on pg 124

64-channel, 100-MHz logic analyzer overlaid with eight 400-MHz channels *(Intech Instruments Div)*

REPRESENTATIVE HIGH-SPEED TIMING LOGIC ANALYZERS

MANUFACTURER	MODEL	CONFIGURATION	EXTERNAL CLOCK (MHz)	INTERNAL CLOCK (MHz)	PRICE	MAX ASYNCHRONOUS SAMPLING RATE SAMPLES/SEC)
DOLCH LOGIC INSTRUMENTS	COLT	MAINFRAME*			$9500	
	OPTION	48 CHANNELS × 1k BITS/CHANNEL	100	100	$8950	100M
	OPTION	16 CHANNELS × 512 BITS/CHANNEL	100	300	$5950	300M
	64300	MAINFRAME INCLUDES: 48 CHANNELS × 1k BITS/CHANNEL AND	25	25	$11,900	50M (16 CHANNELS × 2k SAMPLES)
		16 CHANNELS × 1k BITS/CHANNEL	NONE	300		300M
GOULD	K450XL	MAINFRAME INCLUDES: 48 CHANNELS × 2k BITS/CHANNEL	50	100	$17,975	200M (24 CHANNELS × 4k SAMPLES)
	K500-D	MAINFRAME INCLUDES: 8 CHANNELS × 2k BITS/CHANNEL	130	500	$17,500	500M
HEWLETT-PACKARD	HP 1631A	MAINFRAME INCLUDES: 27 CHANNELS × 1k BITS/CHANNEL AND	25	NONE	$11,000	N/A
		8 CHANNELS × 1k BITS/CHANNEL AND	25	100		100M
		2 CHANNELS × 1k BITS/CHANNEL	NONE	200		200M
	HP 64110	MAINFRAME			$11,150	
	OPTION	32 CHANNELS × 4k BITS/CHANNEL	125	200	$23,350	400M (16 CHANNELS × 8k SAMPLES)
INTECH	2330	MAINFRAME INCLUDES: 64 CHANNELS × 512 BITS/CHANNEL	100	100	$17,975	100M
	OPTION	8 CHANNELS × 2k BITS/CHANNEL			$4985	400M
KONTRON ELECTRONICS	SERIES III	MAINFRAME INCLUDES: 64 CHANNELS × 8k BITS/CHANNEL	50	50	$18,000	100M
	OPTION	8 CHANNELS × 2k BITS/CHANNEL	NONE	250	$5000	500M
NICOLET	800E	MAINFRAME INCLUDES: 16 CHANNELS × 1k BITS/CHANNEL	75	200	$9900	200M
PHILIPS	PM3551/10	MAINFRAME INCLUDES: 35 CHANNELS × 1k BITS/CHANNEL	14.3	NONE	$7500	N/A
	OPTION	4 CHANNELS × 256 BITS/CHANNEL AND	NONE	300	$3000	300M
		8 CHANNELS × 256 BITS/CHANNEL	NONE	50		50M
	PM3570	MAINFRAME			$4750	
	OPTION	32 CHANNELS × 512 BITS/CHANNEL	50	100	$9000	400M (8 CHANNELS × 512 SAMPLES)
ROHDE & SCHWARZ	LAS	MAINFRAME INCLUDES: 48 CHANNELS × 1k BITS/CHANNEL AND	20	20	$21,685	20M
		8 CHANNELS × 1k BITS/CHANNEL	100	100		100M
	OPTION	8 CHANNELS × 4k BITS/CHANNEL	100	400	$8560	400M
TEKTRONIX	DAS9200	MAINFRAME (PLUS TERMINAL)			$11,800	
	OPTION	16 CHANNELS × 4k BITS/CHANNEL	200	200	$9800	200M
	OPTION	8 CHANNELS × 8k BITS/CHANNEL	NONE	2000	$26,000	2G

NOTES:
N/A = NOT APPLICABLE

* ALL MAINFRAMES INCLUDE DISPLAY, KEYPAD, POWER SUPPLY, AND OPERATING SYSTEM
** THREE USER-SELECTABLE SETUP AND HOLD TIME COMBINATIONS: 2.5 nSEC/0.0 nSEC, 1.5 nSEC/1.0 nSEC, OR 0.5 nSEC/2.0 nSEC

MAX TIMING RESOLUTION (nSEC)	DATA-SETUP TIME (nSEC)	DATA-HOLD TIME (nSEC)	CHANNEL-TO-CHANNEL SKEW (nSEC)	TRIGGERS ON A GLITCH	MIN DETECTABLE GLITCH (nSEC)	COMMENTS
10	5	2	2	NO	5	GLITCH CAPTURE ON FIRST 16 CHANNELS ONLY
3.3	8	0	2	NO		NO GLITCH-CAPTURE CIRCUITRY
20	5	2	2	NO	5	GLITCH CAPTURE ON FIRST 16 CHANNELS ONLY
3.3	8	0	2	NO		NO GLITCH-CAPTURE CIRCUITRY
5	8 (TYP)	0	2 (TYP)	NO	5	100-pSEC RESOLUTION ON 8 CHANNELS WITH OPTIONAL LOGIC PROBE ($4995)
2	2.5	0	1	NO	2	GLITCH CAPTURE TO 200 MHz
N/A	20	0		—	—	
10	20	0	—	YES	5	GLITCH CAPTURE ON 4 CHANNELS
5						6-BIT VERTICAL RESOLUTION ON 2 ANALOG CHANNELS
2.5	4	0.5	1.5	YES	3	DUAL-THRESHOLD MODE FOR 3 LEVELS OF VERTICAL RESOLUTION
10	2	2	2 (TYP)	YES	3	RESULTS OF 4 INDEPENDENTLY CLOCKED BLOCKS OF CHANNELS ARE TIME-ALIGNED FOR DISPLAY
2.5	2	2	2 (TYP)	NO		NO GLITCH-CAPTURE CIRCUITRY
10	2	2	2	YES	5	GLITCH CAPTURE ON HALF THE CHANNELS WHEN CHANNELS ARE IN NONINTERLACE MODE
2	2	2	2	YES	2	
5	5	5	2	NO	3	GLITCH CAPTURE ON HALF THE CHANNELS
N/A	25	0		NO		NO GLITCH-CAPTURE CIRCUITRY
3.3	—	—	1	NO		NO GLITCH-CAPTURE CIRCUITRY
20	25	0	2	NO	5	
2.5	—	—	2	NO	4.7	
50	20	0	15	NO		NO GLITCH-CAPTURE CIRCUITRY
10	7	0	3	YES	5	TWO GLITCH-CAPTURE MODES
2.5				NO		NO GLITCH-CAPTURE CIRCUITRY
5	**	**	1	YES	2	GLITCH CAPTURE ON HALF THE CHANNELS AT 100 MHz
0.5	—	—	0.5	YES	1.5	MEMORY DEPTH IS 4k BITS/CHANNEL. WHEN GLITCH CAPTURE IS ENGAGED, ANALYZER OPERATES TO 200M SAMPLES/SEC.

As a rule, a logic analyzer's memory serves a dual role: It both records logic-level transitions and acts as a timer.

all 96 channels in synchronous or asynchronous data-sampling modes at speeds as high as 200 MHz. The triggering circuitry on each 16-channel card can operate at a 200-MHz rate, regardless of the complexity of the triggering setup expression.

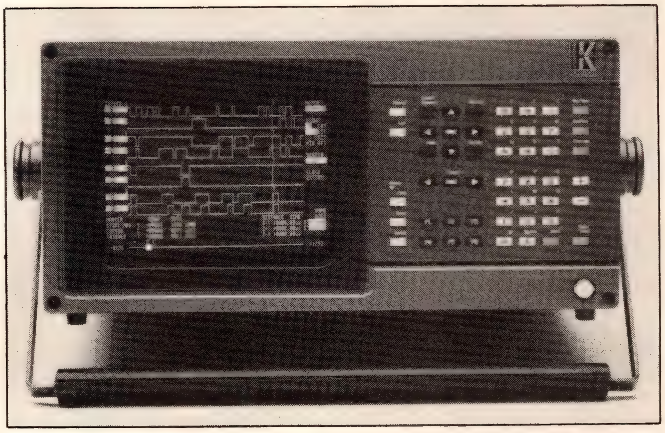
You can time-correlate and display the data captured from a 200-MHz card with data collected from any other single acquisition module in the DAS 9200, even if that module is in an expansion mainframe. These modules can include the 60- and 90-channel, 20-MHz acquisition cards; the 16- and 36-channel pattern-generator cards; and the 8-channel, 2-GHz acquisition modules.

Tektronix's 2-GHz data-acquisition modules are currently the fastest available. At the 2-GHz maximum sampling rate, you can resolve logic events to 500 psec. Each of the 2-GHz channels is backed by 8k bits of memory.

As with the 200-MHz acquisition cards, you can also tightly couple several of the 2-GHz modules to operate as a single unit. The tightly coupled unit can have as many as 32 channels. However, you can specify trigger conditions only across a maximum of eight channels, which must all be part of the same module.

You can also combine 2-GHz modules to form a loosely coupled 160-channel, 2-GHz logic analyzer. You control the resulting system from the color terminal through the DAS 9200's control bus and instrument bus.

***Combination state/timing logic analyzer with 2-channel digital storage oscilloscope** (Hewlett-Packard Co)*



***64-channel, 100-MHz logic analyzer overlaid with eight 500-MHz channels** (Kontron Electronics)*

Although each channel in Tektronix's 2-GHz acquisition module is backed by 8k bits of memory, the measurement window is only 4.1 μsec wide. Even when you slow the sampling speed to 200 MHz, the measurement window is only 41 μsec wide.

Transitional timing expands data window

If you need to measure, with 10-nsec resolution, two events that are separated by milliseconds or even seconds, you do have an alternative. You can use Philips' PM 3570 logic analyzer with its 32-channel high-speed module. The module offers configurations ranging from a 32-channel, 100-MHz data-acquisition system to a 4-channel, 400-MHz system. Instead of backing each channel with a large amount of memory, Philips uses a different data-acquisition scheme to increase the analyzer's measurement window.

The Philips PM 3570 analyzer is unlike conventional analyzers, which store data in memory every sample period, whether or not the monitored signals have changed. A conventional logic analyzer's memory serves a dual purpose: It records the fact that a logic-level transition has occurred, and it acts as a timer by storing data at every sample period. By storing data at each sample point, the analyzer preserves the time relationship between logic events. In short, the conventional logic analyzer uses some of its memory to store transition-occurrence data, and it uses the rest of its memory to keep track of the time between those transitions.

Philips's PM 3570, however, uses separate circuits and memories to handle the transition-recording task and the timing-recording task. The PM 3570 samples the data at a fixed rate, but it doesn't store any data

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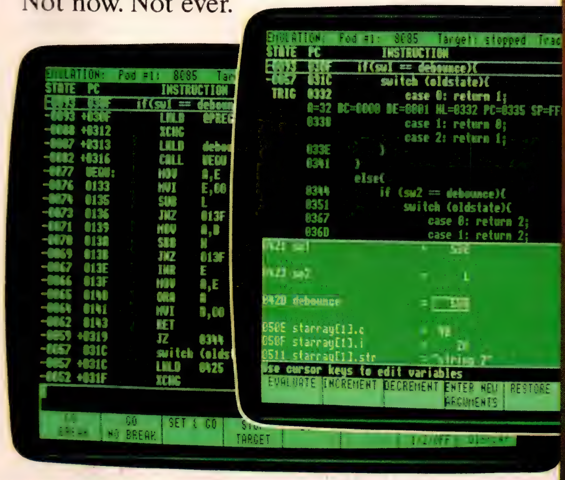

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Logic-analyzer vendors define a glitch as any even number of signal transitions between two of a logic analyzer's sample points.

until it detects a logic transition. When it detects a transition, it stores the transition data in one memory and the time in a second memory. As the analyzer continues to sample the data, a counter counts the number of sample periods that occur. When a second transition occurs, the analyzer then stores the second logic transition in the first memory and the number of counts in the second memory. When the recording is complete, the analyzer's microprocessor reconstructs the timing diagram from the transition information stored in the first memory and the timing information stored in the second memory.

Because it splits the data-collection process into two parts, the PM 3570 analyzer doesn't have to limit its measurement window to the product of the sample period and the memory size. In the transitional timing analyzer, the measurement window is the product of the size of the counter times the sample period times the memory size. So instead of being limited to microsecond or even millisecond windows, the PM 3570 can capture, in a single recording, two 5-nsec pulses separated by more than 20 minutes.

Timing probe has 100-psec resolution

Gould offers a probe that lets you make timing measurements with resolution better than 500 psec. The HR1000/ATC probe ($4995) plugs into the front of the company's K450 logic analyzer. You connect the probe's eight leads to the system under test and take measurements as usual. When you want to make a high-resolution timing measurement on a single channel or between two channels, you call up the HR-1000/ATC setup menu on the K450's screen and select the desired resolution (to 100 psec) and the channels to be measured. When the K450 analyzer has collected enough samples, it displays the answer digitally on its screen. The HR-1000/ATC uses the same timing technology that timer/counters use to make a time-interval-average measurement. As with timer/counters, the probe can measure only repeated events; it can't measure single-shot events.

Vertical resolution solves analog problems

You can compare a timing logic analyzer to a multichannel digital storage oscilloscope having only one bit of vertical resolution on each channel. If you're going to use your logic analyzer to solve analog problems, you'll need an analyzer that has more vertical (voltage) resolution on each channel. The faster the logic in your system runs, the more your system's transmission-line effects alter the digital signals that you need to measure.

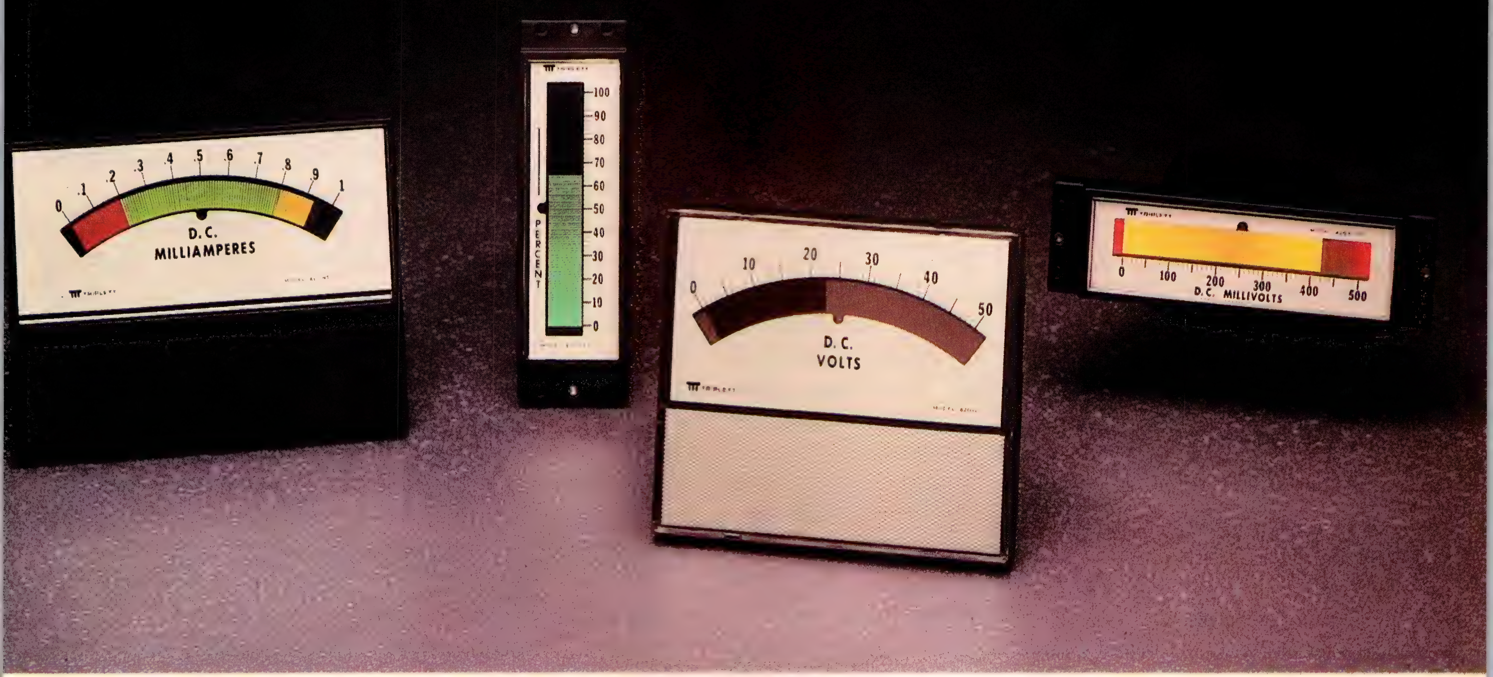
To isolate marginal signals caused by transmission-line effects, you can use the high-speed timing/state analyzer module for Hewlett-Packard's HP 64000 system. The module has a vertical-resolution measurement mode of one in three parts. The analyzer lets you set two threshold voltage levels: You set one of the analyzer's threshold levels at your logic's maximum acceptable low-voltage level and the other threshold at its minimum acceptable high-voltage level. Then you can use the analyzer to isolate marginal signal levels caused by transmission-line effects, excessive fanout, defective components, weak pull-downs, and noise, for example.

The HP 64000's high-speed timing/state analyzer module is 32 channels wide and has a 4k bit/channel memory. Its basic clock rate is 200 MHz. By interleaving the memories, you can sample data at a 400-MHz rate across 16 channels. (The memory doubles to 4k bits/channel.) When you use the analyzer in the dual-threshold mode, you can use only 16 channels at 100 MHz.

Gould and Rohde & Schwarz provide higher vertical resolution for their analyzers by adding analog channels to the machines. Gould's K500-D has one channel that uses a 4-bit A/D converter. This analog channel is coupled to the analyzer's eight logic-analysis channels. It captures data whenever the analyzer is triggered. The analog channel, which uses the analyzer's clock,

***Combination state and timing logic analyzer with eight 400-MHz timing channels** (Rohde & Schwarz)*

Eye-Tech



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A transitional timing logic analyzer samples data at a fixed rate but doesn't store any data until it detects a logic transition.

can operate to 500M samples/sec; the recorder has an analog bandwidth of 100 MHz. The analog channels on Rohde & Schwarz's LAS system run at 20M samples/sec. The channels have eight bits of resolution and a 5-MHz bandwidth.

Kontron's Series III logic analyzer uses another technique to catch analog data. Instead of adding separate analog channels, the Series III uses 16 of its digital channels with its LA-ASA analog probe ($1995) to get a 100-MHz, 6-bit analog channel. By trading 16 analyzer channels for one analog channel, the company increases the analyzer's triggering flexibility.

Like Hewlett-Packard's HP 64000, the Kontron LA-ASA has two mechanisms for setting threshold level. You can program the analyzer to trigger when the input signal is under, between, or above the two threshold voltage levels. Because the Series III can poll the threshold comparators sequentially, you can program a sequence of threshold transitions as a trigger condition. In fact, you can program a sequence of as many as 14 levels of trigger conditions.

You can also poll the time differences between threshold transitions detected by the analog probe and use that information in your trigger program. You can use the conditions on the analog probe to trigger the digital acquisition channels, or you can use the conditions on the digital channels to trigger the analog probe. Alternatively, you can use a combination of the conditions on both the analog probe and the digital channels to trigger the analyzer.

Hewlett-Packard's HP 1631A logic analyzer offers similar triggering capabilities. By adding separate triggering, display, and post-processing controls to the analyzer's two separate analog channels, Hewlett-Packard gives these channels the capabilities of a digital storage oscilloscope. In fact, the 1631A combines the capabilities of three instruments: a 27-channel, state logic analyzer; an 8-channel timing logic analyzer; and a 2-channel digital storage oscilloscope.

The 8-channel 1631A operates to 100 MHz and backs each channel with 1k bits of memory. Each of the scope channels has a 200M-sample/sec digitizer with 6 bits of resolution. The analyzer time-correlates the data collected by its three functions, so you can use the triggering of one function to locate problems in the other two. For example, you can use a software condition to arm the timing-analyzer and scope functions. When the recording is complete, the display presents the timing patterns and the analog waveforms on the screen at the same time, using the same time axis.

You can use a separate menu to program the position of the analyzer's display cursors on the expected waveforms, so the analyzer can automatically make a channel-to-channel or single-channel time-interval measurement. You can also ask the analyzer to make multiple measurements and display the mean time interval and its standard deviation to a ±1.5-μsec accuracy. **EDN**

Article Interest Quotient (Circle One)
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For more information . . .

For more information on the high-speed timing logic analyzers described in this article, contact the following manufacturers directly or circle the appropriate numbers on the Information Retrieval Service card.

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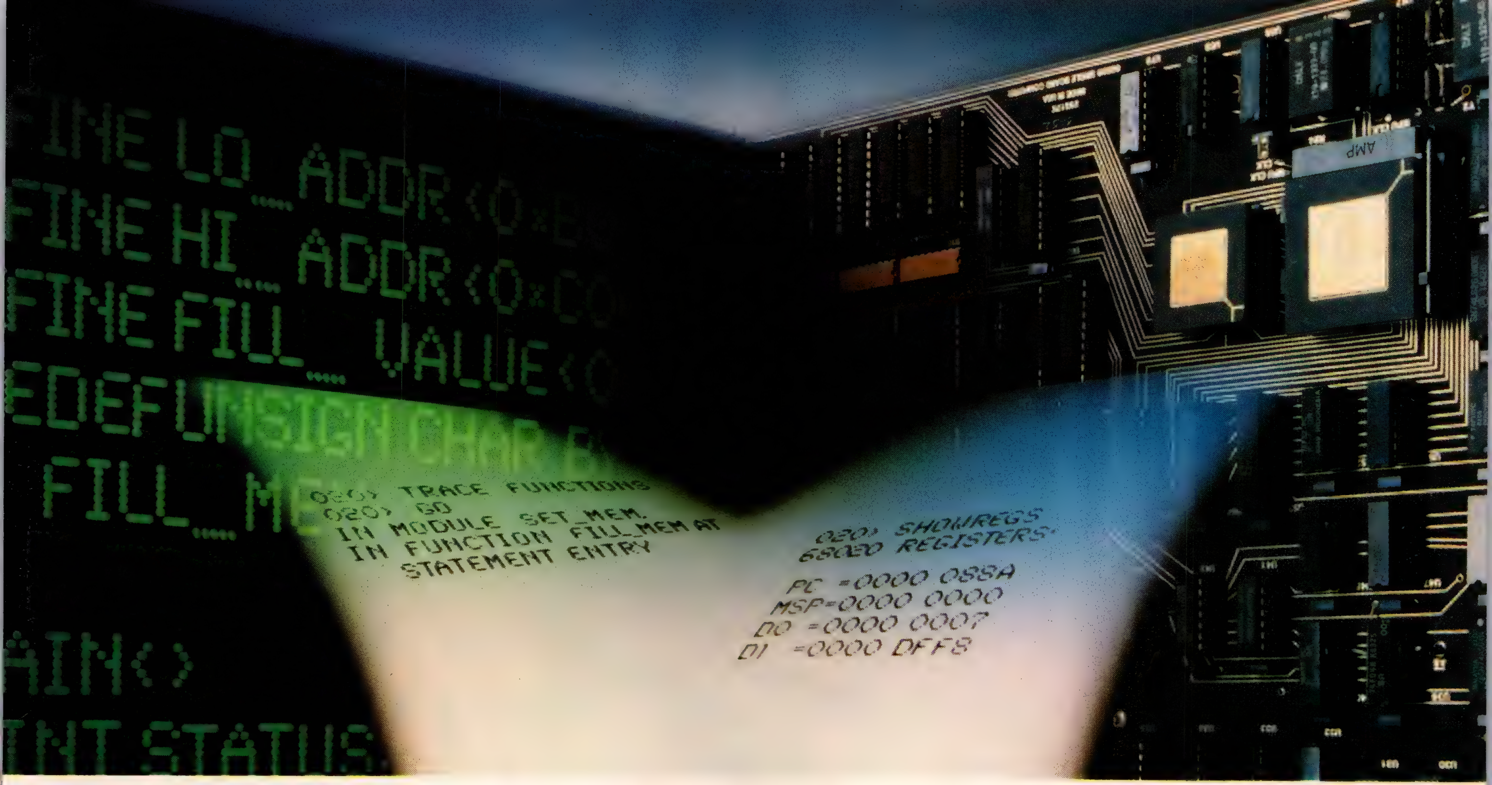

```
020> TRACE FUNCTIONS
020> GO
IN MODULE SET_MEM
IN FUNCTION FILL_MEM AT
STATEMENT ENTRY
```

```
020> SHOWREGS
68020 REGISTERS:

PC  =0000 088A
MSP=0000 0000
D0  =0000 0007
D1  =0000 DFF8
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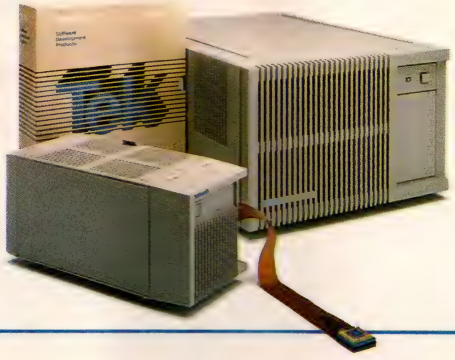

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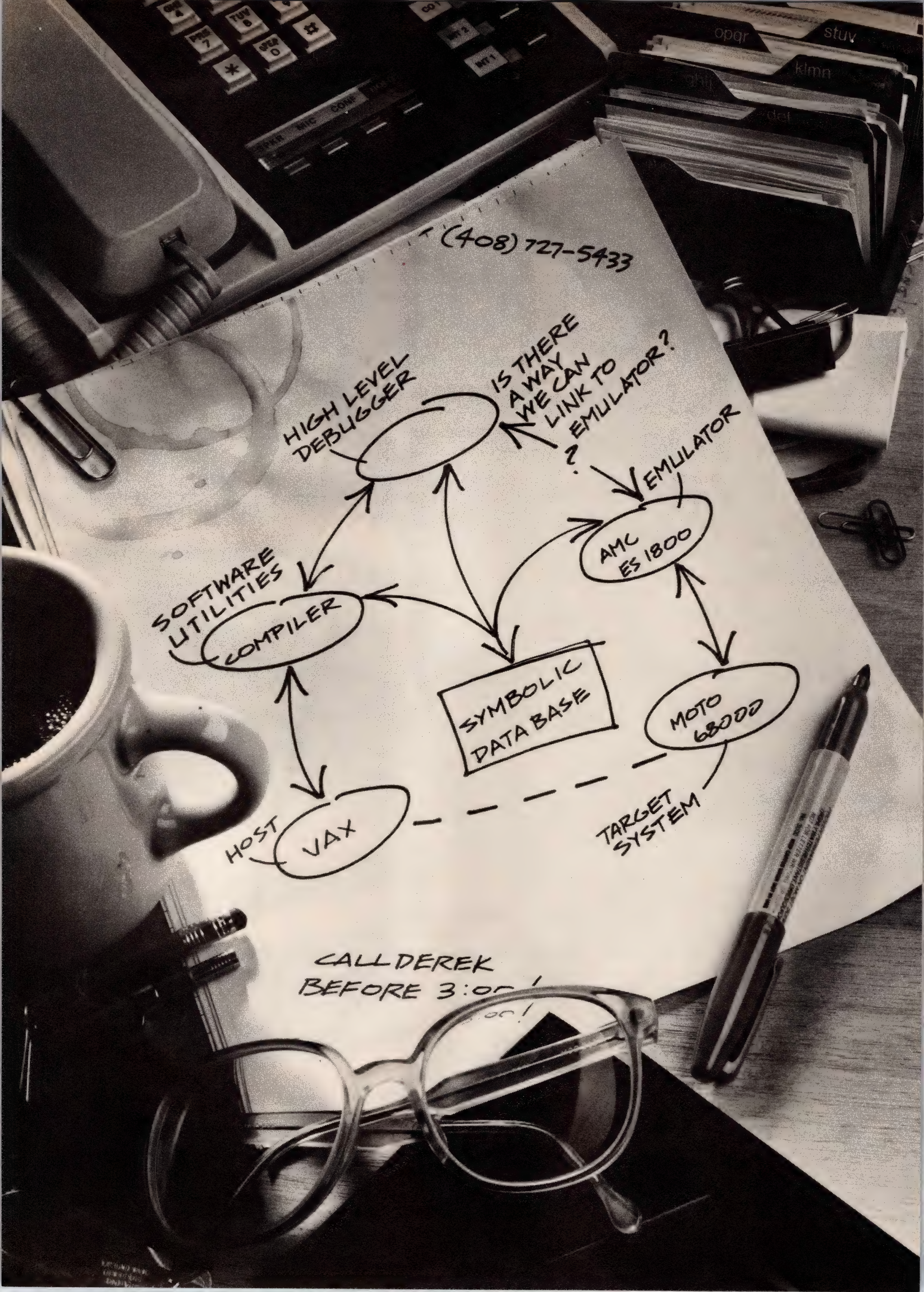
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The development system you need won't exist until we create it for you.

HOSTS	OPERATING SYSTEMS	TARGETS	LANGUAGES	TOOLS
VAX MicroVAX UNIX-oriented workstations · Apollo · Sun · IBM AT MS-DOS workstations · PC · PC XT · PC AT	VMS ULTRIX UNIX XENIX MS-DOS	8048 family, 8080, 8085, 8086/88 and 80186/188 6800/2/8, 6809/9E, 68000/8/10 and 68020 Z80, MK3880/4 and Z8001/2/3 NSC-800	C Pascal FORTRAN PL/M Assembler	Assemblers Linkers Locaters Compilers Symbolic debuggers Source-level debuggers

A stand-alone or remote control system of fully integrated debug tools built on high performance emulation.

Applied Microsystems lets you link the powerful tools you need with ease and precision.

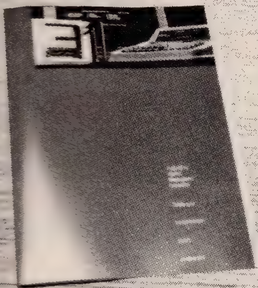
Unless your system has off-the-shelf bugs, you can't solve your problems with off-the-shelf development tools. But if you try to pull all the pieces together yourself you'll spend long frustrating hours and still wind up with a development system that falls short of your needs.

Applied Microsystems met the need for customer integrated development systems (CIDS) by developing a new method of linking development tools. With the CIDS method you will have a seamless, painless interface that allows you to match your host, language, operating system, and software requirements to your engineering methods and target, be it Intel, Motorola or Zilog.

Debug tools for your integrated development environment.

Whether you're working on an 8-bit, 16-bit or even 32-bit microprocessor design, Applied Microsystems lets you tailor the emulation and debug tools you need. Everything from symbolic and source-level debuggers to assemblers, cross-compilers and utilities. While this chart gives you some idea of the power and convenience of the CIDS method, it can only hint at the power, control and visibility you will enjoy.

Validate™ links emulation with symbolic and source-level debugging.



When your software engineers only speak C and your emulator only speaks assembler, your development tools are worse than worthless. If your function is in assembler and your debugger speaks only C, you've got the same problem. The power of the Validate environment is that it works equally in high level languages and in assembler. You don't sacrifice any power or any comfort.

Call toll-free and ask for the proof.

Discover why customer integrated development systems are the fastest and easiest ways to start and finish a design project. For technical and application details call 1-800-426-3925. In Washington, call (206) 882-2000. Or write Applied Microsystems Corporation, P.O. Box 97002, Redmond, WA 98073-9702.

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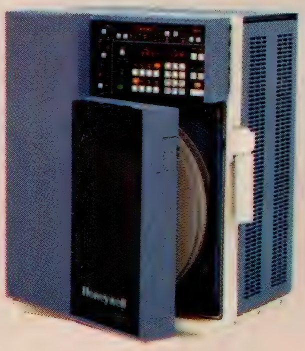
CIRCLE NO 96

Standard equipment for those who don't use the Model 101 recorder.

You don't need to be lucky with the Honeywell Model 101 portable recorder.

The Model 101 is reliable. First and foremost. With features built for function, not fashion. • Microprocessor-controlled auto test allows calibration verification at the speed *you* select • Solid-ferrite heads warranted for 5,000 hours are so stable that the need to re-equalize is practically eliminated • Vibration-isolated transport for reliable operation in mobile environments • Average Mean Time Between Failure (MTBF) is 2,000+ hours • Spare parts available overnight through a worldwide service network.

For details, contact Darrell Petersen, Honeywell Test Instruments Division, Box 5227, Denver, CO 80217-5227. (303) 773-4835.



Together, we can find the answers.

Honeywell

CIRCLE NO 97

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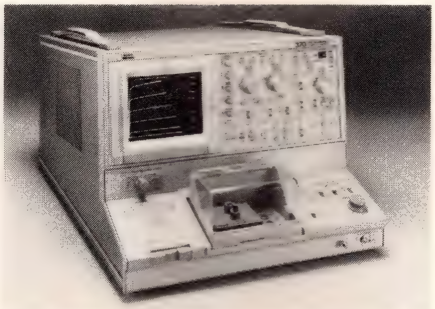
Programmable curve tracer digitizes devices' characteristic curves



Model 370 digital-storage curve tracer measures and displays characteristic curves for 2- to 4-terminal semiconductor devices. Those devices include diodes, transistors, thyristors, FETs, and optoelectronic components. The instrument can perform a range of grounded-emitter or -base tests under manual or program control.

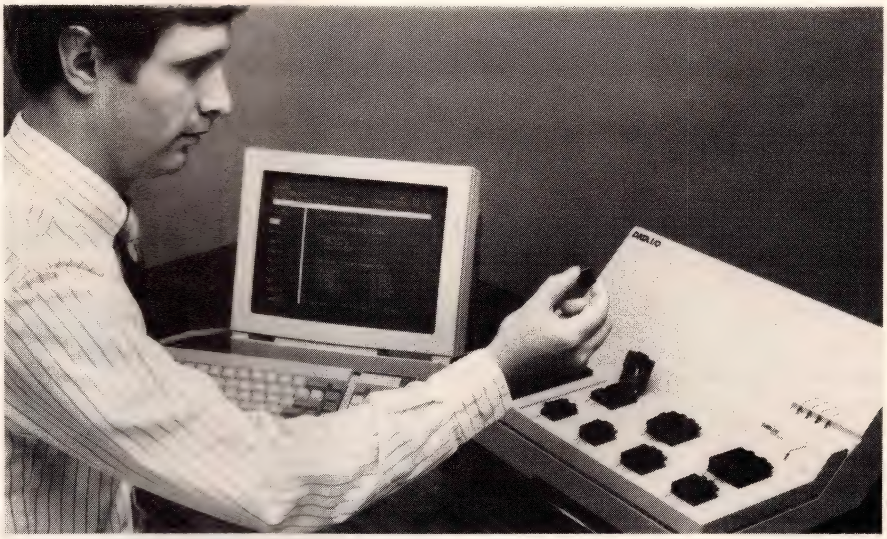
For breakdown measurements, the instrument can supply collector voltage ranging to 2000V pk. Current sensitivity is 100 nA/div. The curve tracer displays the digitized waveforms on a 7-in. CRT. This display shows alphanumeric readouts of vertical and horizontal scale factors, the amplitude of both voltage-and-current step and offset, and β or g_m, as well as cursor coordinates. A built-in bubble memory can save as many as 16 families of curves and 16 front-panel setups. A compare mode allows you to simultaneously display curves stored in memory and curves from a device under test.

The unit has an IEEE-488 interface; it will drive a plotter directly and automatically execute a sequence of 16 tests without the aid of an IEEE-488 controller. $15,000.

Tektronix Inc, Marketing Communications Dept, Box 1700, Beaverton, OR 97077. Phone (800) 547-1512; in OR, (800) 542-1877.

Circle No 598

Universal programmer handles 1200 devices ranging from PROMs to single-chip μPs



The Unisite 40 universal programmer can program virtually any programmable-logic device (PLD) you can plug into a 40-pin DIP socket. Devices supported include all currently marketed PROMs, EPROMs, EEPROMs, single-chip μPs, PALs, integrated-fuse-logic, and field-programmable logic arrays. The unit works with all current technologies: MOS, CMOS, ECL, bipolar, DEAP (diffused-eutectic-aluminum process), and AIM (air-isolated monolithic). An optional adapter handles surface-mounted components in PLCC and SOIC packages.

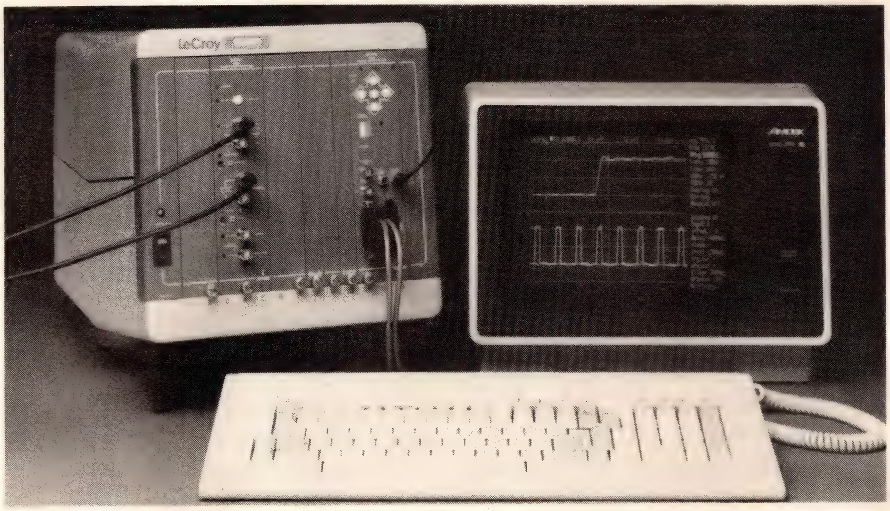
The programmer requires a dumb terminal for operation (you can use a personal computer if you wish). Software prompts the operator through a multilevel menu with windows. The software also provides a help function. PLD-specific software sets up the programmer's drive electronics for the particular device you select. This software conforms to PLD manufacturers' most recent programming and testing algorithms. The 3½-in. disks run on the IBM lap computer. The programmer incorporates one disk drive; a second drive is optional. The unit comes with a 128k×8-bit memory, expandable to 512k×8-bit.

The unit accepts data in 41 formats over its two RS-232C ports. Formats include common ones such as those developed by Motorola, Intel, and JEDEC, as well as less common ones like RCA Cosmac. The programmer weighs 20 lbs and measures 18×43.5×36 in. $11,000. Delivery, six weeks ARO.

Data I/O Corp, Box 97046, Redmond, WA 98073. Phone (206) 881-6444. TLX 152167.

Circle No 597

Custom CCD array speeds digitizer to 1.3G samples/sec with 8-bit resolution



By virtue of a custom charge-coupled-device array, the Model 6880 solid-state waveform recorder can digitize and record signals at 1.3G samples/sec. This digitizing rate is more than six times faster than any other solid-state digitizer. Its sampling period is 742 psec, and it has 8-bit resolution. Thus it can digitize signals with bandwidths from dc to 250 MHz. In addition, this recorder has a 10,000-sample acquisition memory. You can plug as many as six digitizers into one mainframe.

The digitizer requires the company's Model 6010 controller for operation. When operated as a stand-alone benchtop digital oscilloscope, the front-panel pushbuttons located on the controller (or optional keyboard) control the digitizer. The controller's CRT produces a combination of waveforms plus text. In addition to calibrated gain and offset, the CRT displays time and amplitude per division.

The instrument features autocalibration. You can operate it manually or control it over the IEEE-488 bus. The unit also has an RS-232C port, and it can generate hard copy.

The company's Waveforme-Catalyst digital-oscilloscope software can control, display, archive, and process waveforms. It runs on an IBM PC and is included in the digitizer package. Model 6880 digitizer $15,500; Model 6010 controller, $3950.

LeCroy Corp, 700 S Main St, Spring Valley, NY 10977. Phone (914) 578-6084. TWX 710-577-2832.

Circle No 596

Floppy-disk-drive analyzer displays real-time graphics on its CRT

You can use the 887-DJ analyzer, along with an alignment diskette and interface cable, to test and align 3½-, 5¼-, and 8-in. floppy-disk drives having FM and MFM data formats. Instead of making you interpret the raw signals from a disk drive, the tester reduces the data and produces graphic displays on its CRT.

A removable EEPROM cartridge on the front panel stores your test sequences, drive specifications, and pass/fail criteria for one drive. You need one test cartridge for each drive model you test.

You can remove the instrument's keyboard (which you use for configuring the analyzer and creating test sequences), leaving only three keys (Test, Print, and Restart) on the front panel. With this simplified configuration, you can run tests loaded from the EEPROM cartridge but you can't modify them. You can print results either of a single test or of the entire test sequence. By pressing the restart button, you can go to the previous test, and by holding the button down, you can abort and restart the entire test sequence.

The analyzer performs both sequential and random write/read tests. In addition, you can format diskettes on the drive under test. The Model 887-DJ analyzer costs $8500; extra 888-88 EEPROM test cartridges cost $100 each.

Nicolet Oscilloscope Div, 5225 Verona Rd, Madison, WI 53711. Phone (608) 273-5008.

Circle No 603

1400 REASONS TO BUILD YOUR PROGRAMMING FUTURE ON THE 29B.

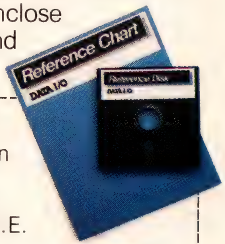
START WITH THE SUPPORT YOU NEED TODAY, AND BUILD YOUR WAY TO UNIVERSAL PROGRAMMING. With algorithms for more than 1400 programmable devices, the 29B Universal Programming System gives you the freedom to choose the right device for your design. And even though we support virtually every device on the market today, you don't have to buy all that support at once. For example, you can start with gang and set programming for EPROMs and EEPROMs. Later expand your system by adding logic or bipolar PROM programming.

Gradually, or all at once, you can build a full universal programming system. Our modular system of paks gives you complete programmable device support and is one of the major reasons the 29B has become the industry standard. You can buy for today's needs, while keeping your options open for future expansion.

MANUFACTURER-APPROVED ALGORITHMS FOR RELIABILITY. Our modular approach to device support is just part of the 29B story. With its manufacturer-approved algorithms, the 29B excels at programming each device accurately. So whether you operate the 29B as a stand-alone, from a personal computer, or a terminal on your company's mainframe, you're guaranteed reliable trouble-free programming, year-after-year.

PROGRAMMING PERFORMANCE FOR TODAY. When successful companies want universal programming support, they turn to Data I/O. For more than 14 years we've maintained a steady commitment to support every device, so that you have the programming performance you need today.

SEND FOR A DATA I/O WALL CHART OR DISKETTE. Start building your future today with the 29B Universal Programming System. Today the 29B supports 1400 devices. Tomorrow it will support even more. To make sure you have the latest listing of device support, complete this coupon and indicate whether you prefer a wall chart or diskette. (Enclose $2.00 for postage and handling.)



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☐ Wall Chart ☐ Diskette (MS-DOS compatible)

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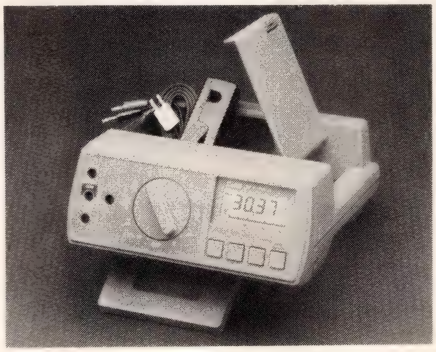
Data I/O Japan Sumitomoseimei Highashishinbashi Bldg., 8F, 2-1-7, Highashi-Shinbashi, Minato-ku, Tokyo 105, Japan (03) 432-6991/Telex 2522685 DATAIO J

CIRCLE NO 98

DATA I/O

3½-digit benchtop DMM features storage compartment for leads

The Model 37 benchtop 3½-digit DMM has a storage compartment built into the rear half of the instrument's case in which you can store test leads and small accessories. A handle is molded into the case for portability. In addition, the instrument's front panel slopes at a 15° angle for better visibility of the LCD. The LCD shows both digital readouts and an analog bar graph. The unit has 0.1% basic accuracy.



Its autoranging meter has a freeze feature that lets you hold a reading until you can view it. For those occasions when you know which range you will be using and don't want to wait for the meter to autorange, the instrument features manual range selection. In addition, it also has an audible continuity tester. The DMM operates for 100 hours from an internal 9V battery, or from line power with the aid of an optional battery eliminator.

The instrument's overload protection meets UL standard 1244. High-energy fuses protect all current ranges including the 10A range. The resistance function is overload protected to 500V rms, and both ac and dc voltage functions are protected to 1000V rms. $229.

John Fluke Mfg Co Inc, Box C9090, Everett, WA 98206. Phone (206) 347-6100. TWX 910-445-2943.

Circle No 600

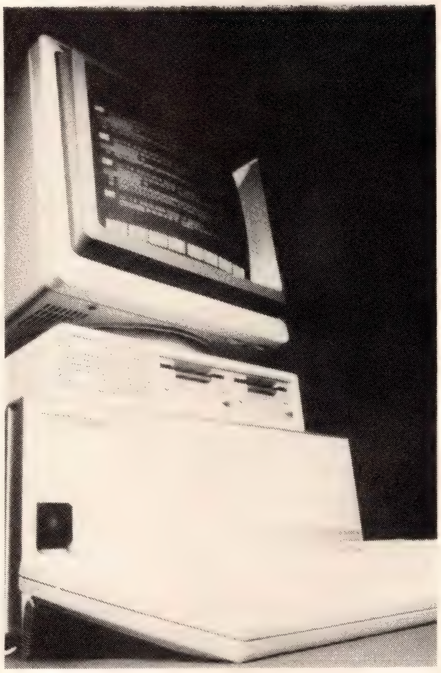
Programmable 802.3 LAN-protocol analyzer traps message frames in 1M-byte buffer

The HP4971S LAN-protocol analyzer lets you test your own IEEE 802.3 or Ethernet baseband 10M-bps LAN. Using the analyzer, you can monitor and capture message frames in a 1M-byte buffer. The analyzer uses 16 user-definable filters for packet-trapping criteria and message-transmission triggers.

You can display the captured frames in hexadecimal, ASCII, or EBCDIC, or in combinations of these three formats. Using a softkey-based programming language, you can configure the analyzer to selectively store message frames from the network, to transmit as many as 16 predefined messages when it receives an appropriate trigger, and to measure network performance by using event timers and counters. You can program the capture feature to start or stop when a filter is matched, so you can see the events that lead to or follow the point of interest. The 4971S also allows complex multiway branching, in which decisions are based on network events and the passage of time between events.

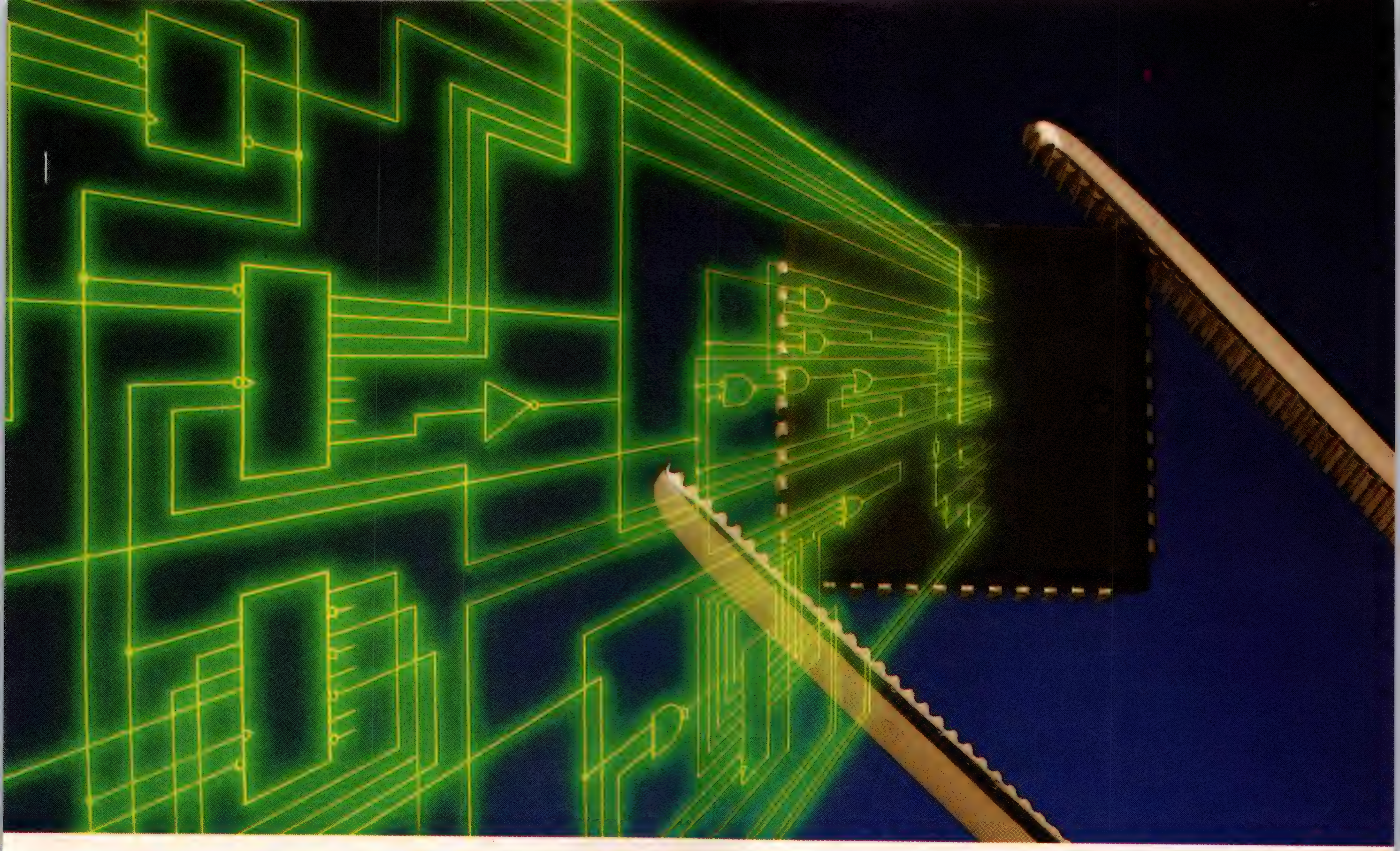
The 4971S supports 16 message-transmission buffers. A message can be transmitted in response to an incoming frame within 10 msec typ. You can define messages that range from 5 to 2026 bytes in length. These limits are beyond the legal limits (1518 bytes max) of Ethernet frames, so you can test a node's reaction to message fragments and jabber problems. The 4971S can load the network by as much as 90% of its capacity. By varying the load that the 4971S generates, you can test a network's sensitivity to loading.

With a keyboard, CRT display, dual floppy-disk drive, media-access unit, and cables, $30,000. Delivery, eight weeks ARO.



Hewlett-Packard Co, 1820 Embarcadero Rd, Palo Alto, CA 94303. Phone local office.

Circle No 605



THE FIRST PROGRAMMER WITH A SINGLE SITE FOR EVERY DEVICE.

NEW UNISITE 40 HANDLES LEADING-EDGE DEVICES WITH SPEED AND EASE. Now you can program and test the latest programmable devices and packages, fast and accurately — all in a single site. The first true universal pin drivers support any device of a given package type in the same site. The UniSite™ 40's single DIP socket handles any device up to 40 pins, including PLDs, PROMs, IFLs, FPLAs, EPROMs, EEPROMs, and microcontrollers. The same site accommodates the most popular PLCCs and SO packages. A 16-bit processor, coupled with custom ICs and high-speed RAM, set new speed records for programming and testing.

TIMELY ACCESS TO TOMORROW'S DEVICES. With universal pin driver electronics hardware, device-specific instructions can be loaded from one 3½" micro-diskette. When new devices are introduced, you simply load a new master diskette, and the UniSite 40 is quickly updated.

MENUS MAKE PROGRAMMING EASY. Use your cursor to select any function. Menus prompt you step-by-step and HELP messages assist you throughout operation. A built-in listing of devices speeds part selection. The UniSite 40 can even save your most frequently used parameters for instant recall.

SHORTCUTS SPEED SETUP. More frequent users can bypass menus and zoom directly to specific operations by selecting key commands. Special software commands, like the ones in our QuickCopy™ mode, are also available to streamline your programmer operation.

DESIGN FREEDOM FOR TOMORROW. When leading-edge designers use the latest programmable devices in their designs, they need the design freedom only the UniSite 40 can provide. Call your local Data I/O representative or **1-800-247-5700** and ask about the next UniSite 40 demonstration in your area.

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(03) 432-6991/Telex 2522685 DATAIO J

DATA I/O

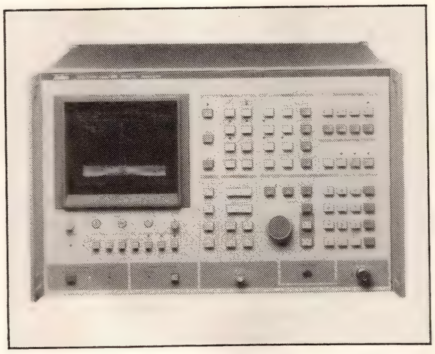
CIRCLE NO 99

Instruments

Spectrum analyzer tunes into signal and sets range automatically

The Model MS612A is a 50-Hz to 5.5-GHz microwave spectrum analyzer. Its resolution for setting start and center frequencies is 1 Hz. The instrument employs a synthesized local oscillator for stable measurements. The instrument has a 110-dB dynamic range and measures signals having levels from −135 to +25 dBm. Its resolution bandwidth ranges from 10 Hz to 3 MHz. A 1001-point×10-bit memory can save an entire screen's data.

You can sweep down to a 100-Hz bandwidth with 10-Hz resolution. Using the max-hold function, you can measure the maximum frequency deviation of a signal. This function aids in measuring an FM signal's frequency deviation or the frequency shift of an FSK signal.



The CRT displays all measurement parameters as well as spectrums in either linear or log mode. The unit can automatically tune in the signal having the highest spectral peak within the instrument's frequency range. An IEEE-488 interface is standard. Options include time bases that increase the instrument's stability by an order of magnitude. $42,130. Delivery, three months ARO.

Anritsu America Inc, 15 Thornton Rd, Oakland, NJ 07436. Phone (201) 337-1111. TLX 642141.

Circle No 601

EEPROM programmer and software package link with μP development system

The Model 824 universal EEPROM, EPROM, and single-chip μP programmer has a 64k-byte memory and an optional 256k-byte memory. It programs most erasable PROMs as large as 512k bits without an adapter (you need an adapter for 1M-bit devices). The programmer executes intelligent programming algorithms from Intel, AMD, and Fujitsu to shorten programming times for large devices.

The device's built-in software uses a combination of dedicated function keys and select-code operations. Functions most frequently used require a single keystroke. The standard RS-232C port allows remote control of the programmer. The unit accepts most common data formats.

The manufacturer's optional Softlink program runs on an IBM PC or an Intel MDS and furnishes file management for your PROM data. Single-keystroke commands give you direct access to each of the programmer's functions. The software also has help functions.

In addition to EEPROMs and EPROMs, the unit programs all Intel 87XX single-chip μPs as well as Motorola's 68701 and 68705 (Motorola's μPs require an adapter). It also features a built-in UV eraser for EPROMs and an erase key for EEPROMs. Model 824, $1295 (256k-byte version $1795); Softlink, $195.

Digilec Inc, 1602 Lawrence Ave, Suite 113, Ocean, NJ 07712. Phone (201) 493-2420. TLX 754098.

Circle No 607

Circle No. 53 for Demonstration
Circle No. 14 for Literature

HOW TO SQUEEZE 10K OF DATA INTO 500 WORDS OF MEMORY.

Out of time, out of luck.

It's bad news, at best.

You've got a timing problem with several events spread over hundreds of microseconds of real-time execution. And you need a logic analyzer that captures them all in a single acquisition.

But your current logic analyzer doesn't have near the memory depth to do it, especially at its highest asynchronous sample rate.

The long timing arm of the LAW.

The Logic Analysis Workstation (LAW) from NWIS brings you a dramatic advance in timing analysis. One that stretches your real-time acquisition window by a factor of 10 or more.

It's done through a feature called transition timing, which only stores timing data when a logic transition occurs. At the same time, a high-speed counter keeps track of the time between transitions and stores it along with each data acquisition.

This means you can display timing diagrams which embrace very wide windows of timing data. With complete data integrity and absolutely no loss in timing resolution.

At a 100 MHz sample rate, you can typically capture timing windows up to 100,000 ns wide. All with only 500 words of memory!

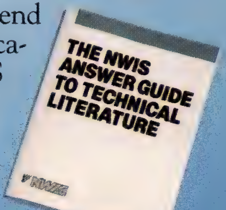
State Analysis and MS-DOS compatibility, too.

Besides the 10-channel, 100 MHz timing analyzer, LAW offers an 80-channel state analyzer with 15 levels of triggering. And also the ability to cross-trigger the two analyzers, and then view the result on a split display with full correlation between disassembled mnemonic state lists and timing diagrams.

And since the LAW is controlled by an IBM PC XT or AT, you can employ a vast array of MS-DOS software tools for post-acquisition processing and documentation.

We'll show you how:

Call us at **800-547-4445** to schedule a LAW demonstration at your facility. Or send for our free publication "The NWIS Answer Guide to Technical Literature."



THE NWIS ANSWER GUIDE TO TECHNICAL LITERATURE

NWIS

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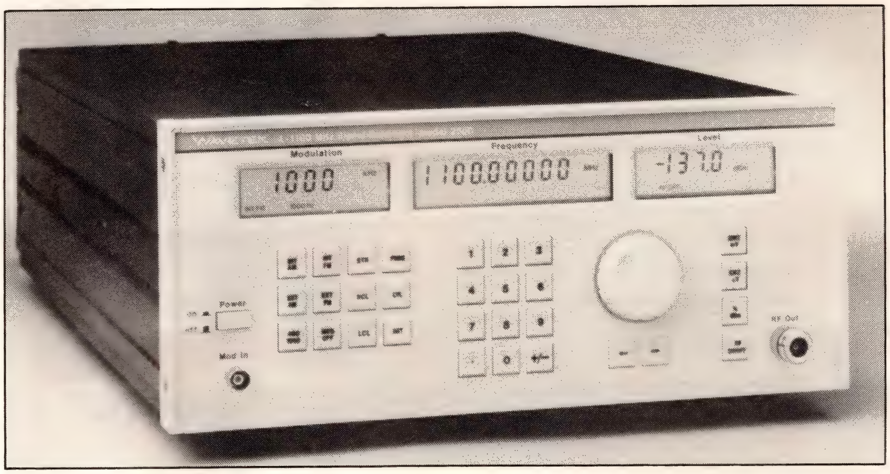
MS-DOS is a trademark of Microsoft Corporation.

NWIS

NORTHWEST INSTRUMENT SYSTEMS, INC.
Am Eichenhag 12
8160 Miesbach, West Germany
Phone: (49) 8025-3260; Telex: 526938

TIMING WAVEFORM DISPLAY 8088 CNS STOPPED
Timebase: 10.00 nS
Mag: 7.680 uS/div
-30.95 uS
+45.15 uS
Function:
)Edit: 0 1 2 3 4 5 6 7 8 9 A B C D E F X (Ins) (Del) ^S=scroll
IBM

IEEE-488-compatible signal generator covers 0.4- to 1100-MHz frequency range



The Model 2500 synthesized signal generator covers a frequency range of 0.4 to 1100 MHz. The instrument's IEEE-488 interface complies with the proposed Standard For Codes and Formats.

The generator's single phase-locked loop employs both fractional division and direct-digital synthesis. This technique permits fine control of the instrument's output frequency without the complex circuitry used in other generators and also with fewer spurious signals, the manufacturer claims. For manual operation, you can set all parameters with either a spin knob or a keypad.

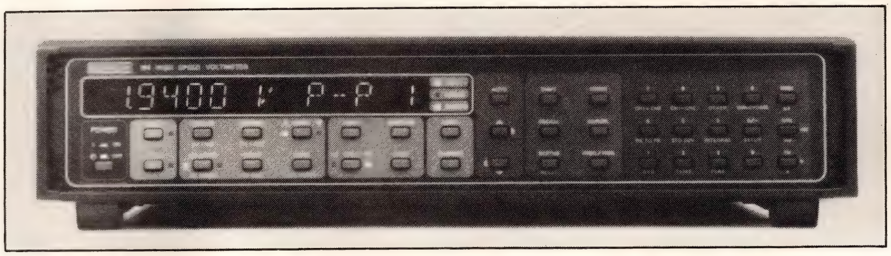
You can control the generator's output through either amplitude or frequency modulation. The standard time base is accurate to 0.5 ppm. The unit can store 15 front-panel setups. It automatically sets all phase-lock and FM parameters; built-in software allows you to optimize the output's flatness within two minutes. Standard features include 50W reverse-power protection.

The instrument has μP-based self-test and internal-calibration routines that are completed within a few minutes. $5695. Delivery, 60 days ARO.

Wavetek, Box 190, Beech Grove, IN 46107. Phone (317) 788-5980. TWX 810-341-3226.

Circle No 599

Single unit combines voltmeter and high-speed, 8-bit digitizer



Model 194 features a 1M-sample/sec, 8-bit digitizer and waveform-analysis software along with a 4½-digit voltmeter. The instrument comes with built-in waveform-analysis routines for averaging, true-rms calculation, integration, and determining standard deviations and peak-to-peak readings. The 194 also identifies the positive peak, the negative peak, and the value of the sample at the trigger point. When an optional second channel is installed, the instrument becomes the Model 1944 system voltmeter, which computes the ratio and difference of parameters from each channel.

The instrument can store 64k 8-bit samples; because the 4½-digit voltmeter mode is equivalent to 16-bit digitization, you can store only 32k 16-bit samples in that mode. The maximum reading rate in that mode is 100k samples/sec.

In the 4½-digit mode, the instrument's dynamic range is 10 μV to 200V; in the high-speed, 8-bit mode, the resolution is 2.56 mV. The programmable sample period, ranging from 1.0 μsec to 1.0 sec, has a minimum increment of 0.1 μsec over the entire range.

The unit operates from any of five trigger sources. It provides an IEEE-488 interface for external control. In DMA mode, the unit transfers data at 90k bytes/sec over the IEEE-488 bus. $3995; the 2-channel Model 1944 adds $1895.

Keithley Instruments Inc, 28775 Aurora Rd, Cleveland, OH 44139. Phone (216) 248-0400. TLX 985469.

Circle No 604

New Probeye® Series 3000 TVS

Now you can get a better thermal image –

but you'll have to accept a trimmer package and a lower price

New Series 3000 TVS from the world's largest producer of infrared equipment combines a sharper infrared image with the flexibility to go wherever thermal imaging is needed.

Improved display resolution (200 lines) and superior RGB color output provide a crisper, more definitive picture of heat patterns in 16 distinct colors.

Lighter, more compact components plus wireless remote control operation get to more places, let you analyze thermal problems from a distance.

Third generation Series 3000 offers temperature coverage from −20 to 1500 degrees Celsius and with temperature resolution as fine as 0.1 degree Celsius.

Microprocessor control features include user-selectable viewing options, direct real-time temperature readout and generation of graphics and alphanumerics.

The lower price includes more standard features than any other system existing today. In addition, you have a choice of desktop 10-inch monitor or compact 3-inch monitor plus a selection of quality accessories for specialized needs.

For more information or for a hands-on demonstration, write or call today. Hughes Aircraft Company, Probeye Marketing, 6155 El Camino Real, Carlsbad, CA 92008. Phone 619/931-3617.

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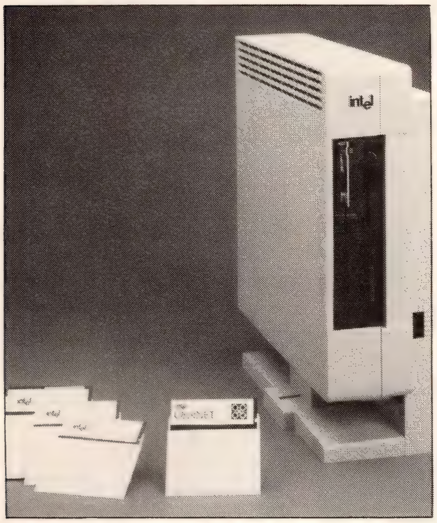
CIRCLE NO 100



LINKING TOOLS

The Network Resource Manager (NRM) file server; the Compilengine, a high-level-language, hardware-based compiler; and two software packages combine to link VAXs and IBM PCs on this company's proprietary network, Opennet.

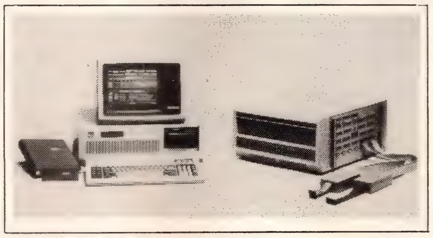
The network follows the 7-layer International Standards Organization model, specifically IEEE 802.3 (Ethernet), ISO message-delivery protocols, and MS Net protocols developed by Microsoft, IBM, and Intel.

The Opennet coexists with Decnet; it requires an Ethernet board to attach an IBM PC to the network. The NRM, a version of the company's superminicomputer, provides file storage, a spooled line printer, and software-development programs. The Compilengine imports and compiles files and then links and locates them when needed. It features an 80286 processor, 1M-byte no-wait-state RAM, and a 40M-byte Winchester disk (to 560M bytes max).

NRN, $14,995 to $23,995; Compilengine, $13,995; PC Link software, $1250; VAX Link software, $7500.

Intel Corp, Literature Dept W274, 3065 Bowers Ave, Santa Clara, CA 95051. Phone (408) 987-8080.

Circle No 602



BIT-SLICE TOOL

This combination of hardware and software, the Step-40 SDT, aids in the development of any microprogrammed product—bit-slice or digital-signal processors as well as ASICs. The software package features a relocatable macro meta-assembler that runs on an IBM PC/AT or RT PC. It also includes a source-level debugger, an editor with a windowing feature, and a disassembler that works with the meta-assembler's code. Performance-analysis tools (such as histograms) are also provided.

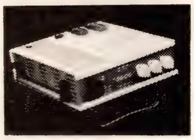
The hardware includes a ROM emulator that substitutes for the target system's control store. The emulator is expandable to an array as large as 64k×512 bits. Also available are real-time emulators for bit-slice processors such as the AS888, AS890, 2910, and 29116. You can order a logic-state analyzer that interacts with the emulator for breakpoint control. From $20,000.

Step Engineering, 661 E Arques Ave, Sunnyvale, CA 94086. Phone (408) 733-7837. TWX 910-339-9506.

Circle No 608

LOGIC ANALYZER

The PM 3570 modular logic analyzer can have as many as 83 state-analysis channels, plus 32 transitional-timing-analysis channels. The analyzer can thus handle μPs as large as 32 bits. The 32 transitional-timing-analysis channels capture data at a rate of 100 MHz. Or you can collapse these 32 channels into eight similar channels that run at 400



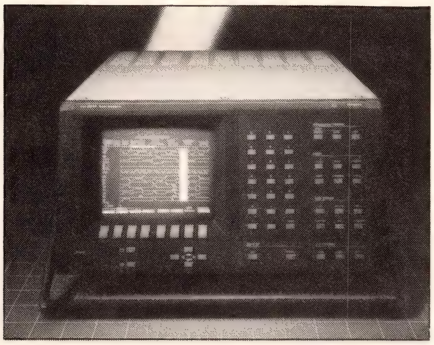
NEW FROM LOGICAL DEVICES INC:

PROMPRO-8X™ Model II

A stand-alone programmer starting at $895.00 can put you in business to program EE/EPROMs PAL/PLDs,* Single Chip micros,* and Bipolar PROMs,* + EPROM IN-CIRCUIT EMULATION* capability that can speed up your development time considerably and an RS-232 communications port that lets you integrate it with your IBM PC as a total firmware and Logic development station.

All from a company with an excellent reputation for quality and service.

A UNIVERSAL DEVICE PROGRAMMER



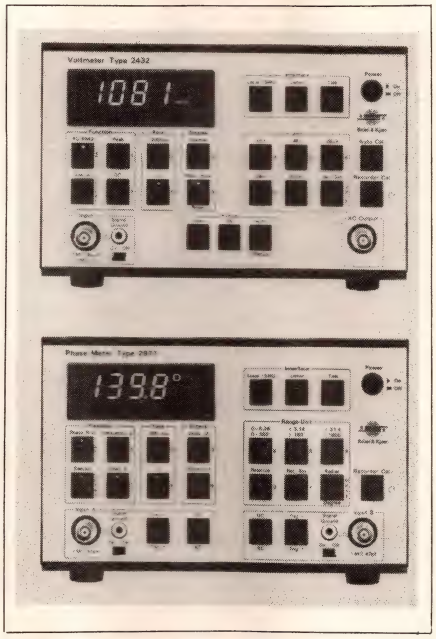
MHz. In this mode, the analyzer can capture 5-nsec glitches.

Further, one transitional-timing plug-in board can control as many as sixteen 200-MHz channels. You can configure mixed channels such as 16 channels at 100 MHz plus 8 channels at 200 MHz.

The two sections of the analyzer can also run synchronously. You can either trigger one module from an event detected by the other module or let both run and get a time-correlated display of timing and state activity captured by both sections. The unit also analyzes software performance. A representative state and timing analyzer, $17,000.

Philips Test & Measuring Instruments Inc, 85 McKee Dr, Mahwah, NJ 07430. Phone (201) 529-3800. TWX 710-988-5348.

Circle No 606



VOLT, PHASE METERS

The Model 2432 voltmeter and Model 2977 phase meter can operate either as stand-alone instruments or in conjunction with the IEEE-488 bus. The 2432 voltmeter has a linear frequency response from 5 Hz to 25 kHz with −0.5-dB rolloff at 2 Hz and 500 kHz. You can scale ac measurements in either rms or peak voltage. The instrument's ac output provides linear amplification of the input signal in 20-dB steps (±0.02 dB).

The 2977 phase meter has center-zero and end-zero phase ranges, with its display and dc output scaled in degrees or radians. The instrument measures over a ±1800° (±31.4-rad) range. It triggers on signals as low as 1.4 mV pk with positive- or negative-slope triggering on either of its two inputs. A built-in delay line provides as much as 163.8 msec of triggering delay. Model 2432, $5783; Model 2977, $5406.

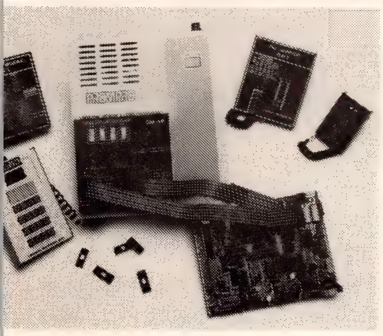
Bruel & Kjaer Instruments Inc, 185 Forest St, Marlborough, MA 01752. Phone (617) 481-7000. TWX 710-347-1187.

Circle No 609

DATA ACQUISITION

The Model 570 data-acquisition system comes with a board that plugs

LEADER IN DEVICE PROGRAMMING



*some devices require optional adaptors.

FEATURES:
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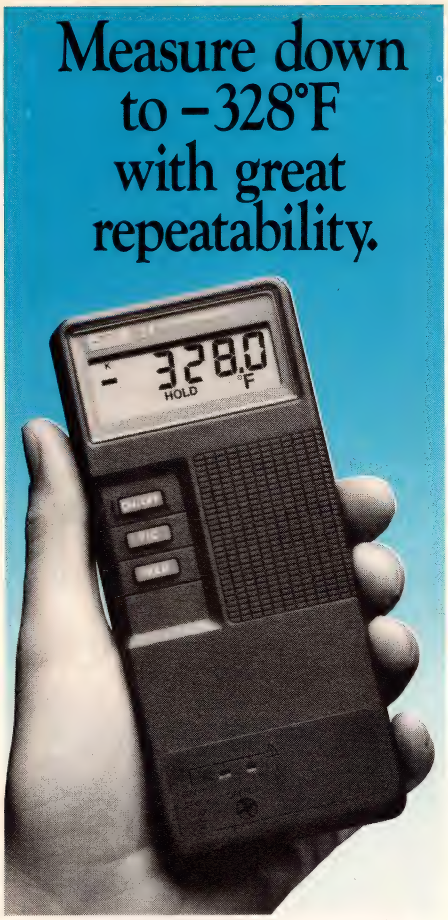
	(02) 736-1564	790 82635

WITH AN UNUSUAL PRICE TAG: $895

CIRCLE NO 102



Measure down to −328°F with great repeatability.

Using any standard K or J thermocouple probe, the new Fluke 51 delivers accurate measurements to 1/10th of a degree, time after time.

It's designed to make tough jobs easy. With simple, push-button features to hold measurements, select °C or °F; even an automatic self-test to check the battery and all critical functions.

And it's designed to last. With a rugged, drop-resistant case and a 3-year warranty — the longest in the industry.

Get yours today. Or ask about the new dual-input Fluke 52 with extra capabilities.

The Fluke 50 Series. Priced from $119.

For the name of your local supplier and a free brochure call toll-free **1-800-227-3800, Ext. 229.**

FROM THE WORLD LEADER IN HANDHELD TEST INSTRUMENTS.

FLUKE 51/52 THERMOMETERS

Measurement range:
K-type: −200°C to +1370°C (−328°F to +2498°F)
J-type: −200°C to +760°C (−328°F to +1400°F)
Accuracy:
K-type is ±(0.1% of reading +0.7°C or 1.3°F)
J-type is ±(0.1% of reading +0.8°C or 1.4°F)
°C or °F Selectable • Hold Mode
Scan, Differential, and Min/Max Recording Modes (52 only)
Standard mini-connector input
1200 hour 9V battery life • 3-year warranty
General-purpose K-type bead probe included (two with 52)
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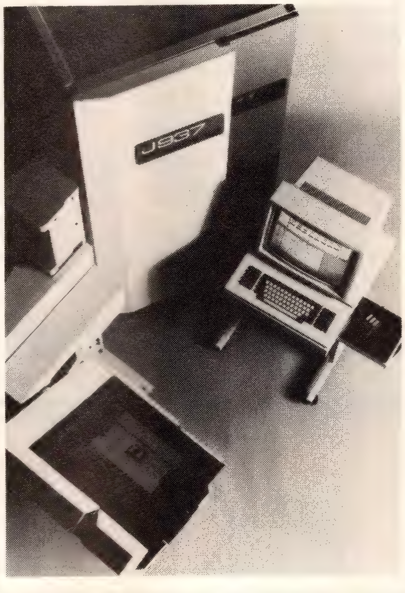
into an IBM PC chassis and a cable that connects the PC to the 570's mainframe. The system features seven data-acquisition boards that plug into its mainframe; 32 single-ended (16 differential) inputs; a programmable amplifier; a 12-bit, digitizer with a sampling rate of 31k samples/sec; dual-channel, 12-bit D/A output; 16 digital inputs and outputs; and 16 power-control outputs. In addition, the unit has an expansion slot that accepts any one of the 16 boards from the company's Series 500 products. The system works with the company's Dadisp spreadsheet program and other data-analysis software such as Asyst and Labtech Notebook. $1295.

Keithley Instruments Inc, Data Acquisition and Control Div, 28775 Aurora Rd, Cleveland, OH 44139. Phone (216) 248-0400. TLX 985469.

Circle No 610

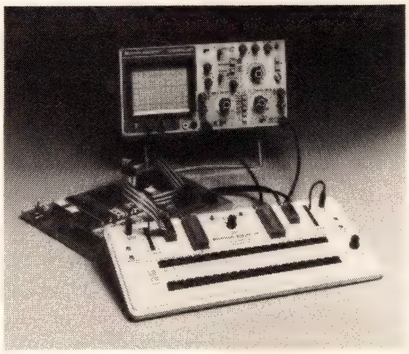


1M-BIT MEMORY ATE

The J937 is the first ATE that can test 1M-bit RAM devices (and 16M-bit modules) at full speed. In addition to standard RAMs, the machine handles video and dual-port RAMs. The tester runs at a 10-MHz cycle rate and a 50-MHz data rate. You can test as many as 16 RAMs at the same time; each of these RAMs can have 12-row- and 12-column-address lines. The unit has an algorithmic pattern generator that generates test vectors for modules as wide as 18 bits. The tester incorporates a Sun Microsystems computer, which runs the Berkeley 4.2 Unix operating system. You program the tester in the company's T900 language (a version of C). $360,000. Delivery, 39 weeks ARO.

Teradyne Inc, Inquiry Systems & Analysis, 25 Drydock Ave, Boston, MA 02210. Phone (818) 888-4850.

Circle No 611



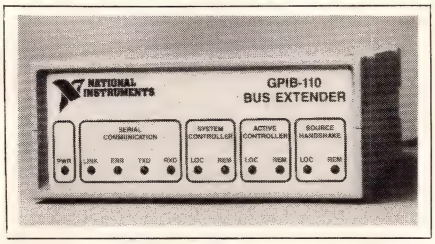
COMPONENT INTERFACE

The Scopemate 2 interfaces a dual-trace oscilloscope to most common components, including resistors, capacitors, diodes, transistors, and ICs. Using the interface, you can compare a component or reference device that is known to be good against a suspected bad component. The instrument displays signatures from both components using the X/Y display mode of your oscilloscope. The unit tests components for shorts, opens, diode action, and leakage with a known ac test voltage (14V rms, 300 μA max). You do not have to interpret any numeric data because major differences in component signatures indicate a bad device. It measures 1.5×14.5×7 in. and weighs 3.1 lbs. $395.

Beckman Industrial Corp, 630 Puente St, Brea, CA 92621. Phone (714) 733-8436. TLX 0678413.

Circle No 612

CIRCLE NO 103



IEEE-488 EXTENDERS

The GPIB-110 bus extender changes the parallel traffic of an IEEE-488 bus into a serial line. The unit can communicate over both coaxial and fiber-optic cable. A similar unit at the other end of the cable transforms the serial traffic back into parallel IEEE-488 signals, thereby allowing you to exceed the 20m max cabling specified in the IEEE-488 standard. When a 30m cable is used, for example, the bus extender can transfer as many as 222k bytes/sec (depending on the length of the serial cable). $1095.

National Instruments, 12109 Technology Blvd, Austin, TX 78727. Phone (800) 531-4742; in TX, (800) 433-3488. TLX 756737.

Circle No 613

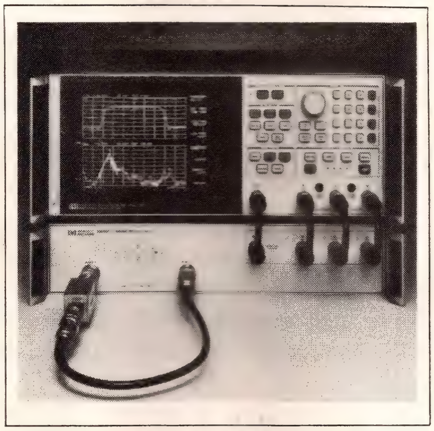
SCSI DEVELOPER

This SCSI development system uses a SCSI interface board plugged into an IBM PC/XT and a set of software packages to aid in the testing and verifying of SCSI devices. The system also includes a real-time clock, monochrome graphics adapter, monochrome display, IBM graphic printer, mouse, and cabling. Software comprises the company's test-function and documentation library, a menu generator, and a report generator as well as Microsoft's C compiler, Borland International's text editor Sidekick, and

IBM's PC Paint. The unit will operate at data rates as high as 2M bytes/sec. $19,500.

Adaptec Inc, 580 Cottonwood Dr, Milpitas, CA 95035. Phone (408) 946-8600.

Circle No 614



NETWORK ANALYZER

The Model 8753A vector network analyzer covers the frequency range of 300 kHz to 3 GHz. It measures the magnitude and phase of transmission and reflection characteristics of a network with resolutions of 0.001 dB and 0.01° over its 100-dB dynamic range. The instrument's dynamic accuracy is ±0.05 dB over a 50-dB range. It can measure group delays as long as one second with 1-psec resolution. The unit has a synthesized-signal source that provides 100-mW, swept-frequency test signals having 1-Hz resolution. It features a 9-in. CRT. $23,500. Delivery, 12 weeks ARO.

Hewlett-Packard Co, 1820 Embarcadero Rd, Palo Alto, CA 94303. Phone local office.

Circle No 615

UNIVERSAL EMULATOR

The Ice-Engine/BX-8 emulates 8-bit µPs. You can control it with an IBM PC, a CP/M computer, or a dumb terminal. The emulator supports the Z80 (A, B, H, CMOS versions), 8085, 6809, and 8048 µPs. The unit has a 64k-byte, mappable emulation RAM, a 40-bit×2k trace memory, a 256-step register-trace memory,

Measure up to 2,498°F in the palm of your hand.

The Fluke 51 is the hottest new handheld thermometer on the market. Using any standard K or J type thermocouple probe, it can precisely measure extreme temperatures with resolution to 1/10th of a degree.

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FLUKE 51/52 THERMOMETERS

Measurement range:
K-type: −200°C to +1370°C (−328°F to +2498°F)
J-type: −200°C to +760°C (−328°F to +1400°F)
Accuracy:
K-type is ±(0.1% of reading +0.7°C or 1.3°F)
J-type is ±(0.1% of reading +0.8°C or 1.4°F)
°C or °F Selectable • Hold Mode
Scan, Differential, and Min/Max Recording Modes (52 only)
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General-purpose K-type bead probe included (two with 52)
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KEY FEATURES:

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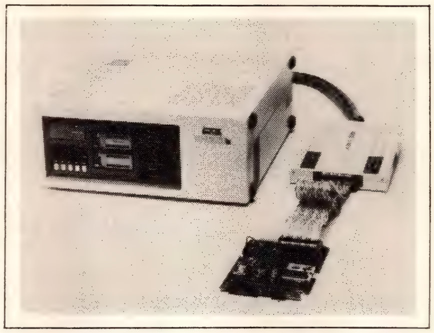


and a symbolic debugger. A resident debug-command language enables you to create macros that execute complex emulation sequences.

Three hardware triggers control functions such as program break and real-time trace. Additional features include a PROM programmer and an eraser for 2716 to 27256 EPROMs, a battery-backed 32k-byte RAM that can retain data for 30 days, and a hardware timer for measuring program execution. A complete system, including one μP-specific interface pod, costs $3995; additional pods, $990 each.

Ziltek Corp, 1651 E Edinger Ave, Santa Ana, CA 92705. Phone (714) 541-2931.

Circle No 616

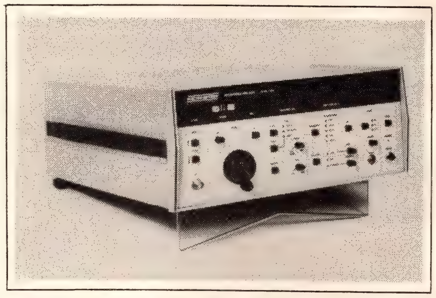
PLD PROGRAMMER

You control the Allpro device programmer via a proprietary parallel interface to an IBM PC. The unit programs EPROMs ranging from 2716s to 27512s and most common PLDs in a single 40-pin socket with no need for personality modules or socket adapters. Leadless-chip-carrier and quad-in-line adapters are available. One floppy disk contains all of the unit's programming algorithms and device footprints. Software supplied with the unit accepts Intel Hex, Motorola Hex, JEDEC, and Signetics' HL fuse-data formats. The software also includes a functional test for those devices.

Each of the unit's socket pins is programmable for voltage, current, and slew rate. For programming new devices, you'll need software upgrades. The company provides these upgrades every 90 days for free for one year after your initial purchase. $2900.

Logical Devices Inc, 1321 NW 65th Pl, Fort Lauderdale, FL 33309. Phone (305) 974-0975. TLX 383142.

Circle No 617



EMI ANALYZER

The EMC-30 MK IV EMI analyzer/receiver conforms to the proposed draft of MIL-STD-462B, the proposed draft of British DEF-STAN 59-41 (Part 3)/2, and ANSI C63.2. The instrument covers a frequency range of 10 kHz to 1 GHz. You can control the instrument over the IEEE-488 bus; software is available for MIL-STD 461/462 compliance, narrow-band and broadband signal-limit comparisons, and test-routine generation.

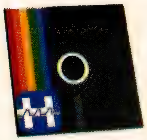
The unit's frequency accuracy is ±0.1%, and amplitude accuracy is ±2 dB. Image, IF, and spurious rejection spec −60 dB typ, and gain flatness is ±1 dB typ. Detectors provide true-average, direct-peak, and slide-back analysis. $39,500.

Electro-Metrics, 100 Church St, Amsterdam, NY 12010. Phone (518) 843-2600.

Circle No 618

Now you can do 11 hours of Rad-Hard ASIC Standard Cell design in only 30 minutes. And the price is right!

Harris has the ASIC design software.



New Harris HD/Mentor Graphics Software lets designers of rad-hard ASICs accomplish a lot more on their Mentor Graphics workstation, in less time. Explore more design alternatives. Analyze them. Eliminate design compromises. Easily. Result: products and systems which work better because they're designed better.

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	Competitor's Gate-Level Models	Harris' Behavioral Models	Improvement Factor
Full Library Size {Disk Space}	7 Mbytes	1 Mbyte	7.0 Times
Expand Time	954 sec.	312 sec.	3.0 Times
Expanded Schematic {Disk Space}	6 Mbytes	1.2 Mbytes	5.0 Times
Simulator Initialization Time	540 sec.	173 sec.	3.1 Times
Simulator Run Time 6100 Vectors/1000 μs	18,500 sec.	645 sec.	28.6 Times
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Design support also available on Daisy™ and SDA workstations.

For more information contact Harris/MHS Semiconductor Sales Ltd., Eskdale Road, Winnersh, Wokingham, Berks, RG11 5TR, England.

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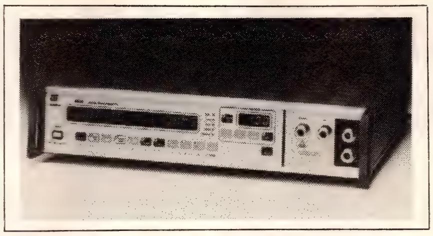
CIRCLE NO 107

Instruments

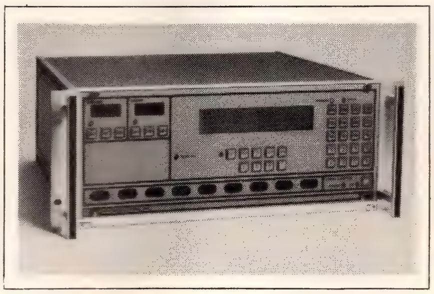


TERAOHMMETER

The Model 6500 digital teraohmmeter automatically selects the correct range, optimum measuring period, and stimulus threshold for measuring extremely high resistances. The instrument, which uses a highly precise, capacitance-resistance transfer technique, measures resistance over 100 kΩ to 10,000 TΩ. It can also measure currents as small as 1 pA. In the picoammeter range, the instrument's impedance is $>10^{13}\Omega$. Applied test voltages can range from 1 to 1000V; measurement times range from 5 msec to 1000 sec. The instrument comes with IEEE-488 and RS-232C interfaces. $9950. Delivery, 90 to 120 days ARO.

Guildline Instruments Inc, 4403 Vineland Rd, Suite B10, Orlando, FL 32811. Phone (305) 423-8215. TLX 856443.

Circle No 619



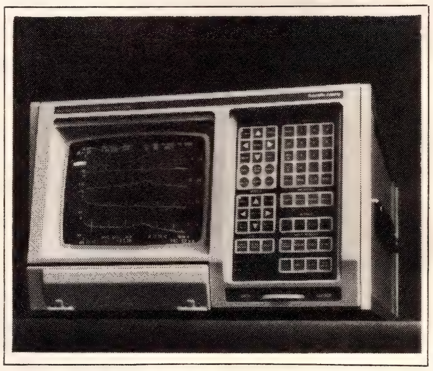
SIGNAL CONDITIONER

The Model 6000 signal-conditioning system combines filters; preamplifiers; postamplifiers; auto gain-ranging amplifiers; charge, strain, voltage and current amplifiers; and frequency-band translators into a single package. The instrument's mainframe will hold as many as 16 function cards. Filters and other functional elements come one, two, or four/card, depending on function.

Available filters include a 1-MHz filter having 80-dB/octave cutoff and a 255-kHz filter having 130-dB/octave rolloff. You can also install a calibration function. You can program the instrument from its front panel and load that program onto an IEEE-488 controller for storage and later use. $3500 to $10,000.

Precision Filters Inc, 240 Cherry St, Ithaca, NY 14850. Phone (607) 277-3350. TLX 646846.

Circle No 620



SIGNAL ANALYZER

The SD380Z stand-alone FFT signal analyzer has multichannel inputs and processes data signals as great as 40 kHz (with optional 100-kHz capability). Processing speed can match a 4-kHz real-time rate with live display updates; when the display is off, the device has a 7-kHz throughput to the unit's memory. Versions with one, two, or four channels are available with 56k-byte input memory, real-time zoom on all channels, variable transform size, and a continuous updating of the 3-D-contour display. RGB outputs for an external color monitor are standard.

Options include a 100-kHz frequency bandwidth, ⅓- and 1/1-octave analysis, a signature-ratio adapter, a signal source, and a 3½-in. floppy-disk drive for nonvolatile data storage. Single-channel SD380-1, $12,750.

Scientific Atlanta, Spectral Dynamics Div, Box 23575, San Diego, CA 92123. Phone (619) 268-7100. TWX 910-335-2022.

Circle No 623

Burst the price/ performance barrier!

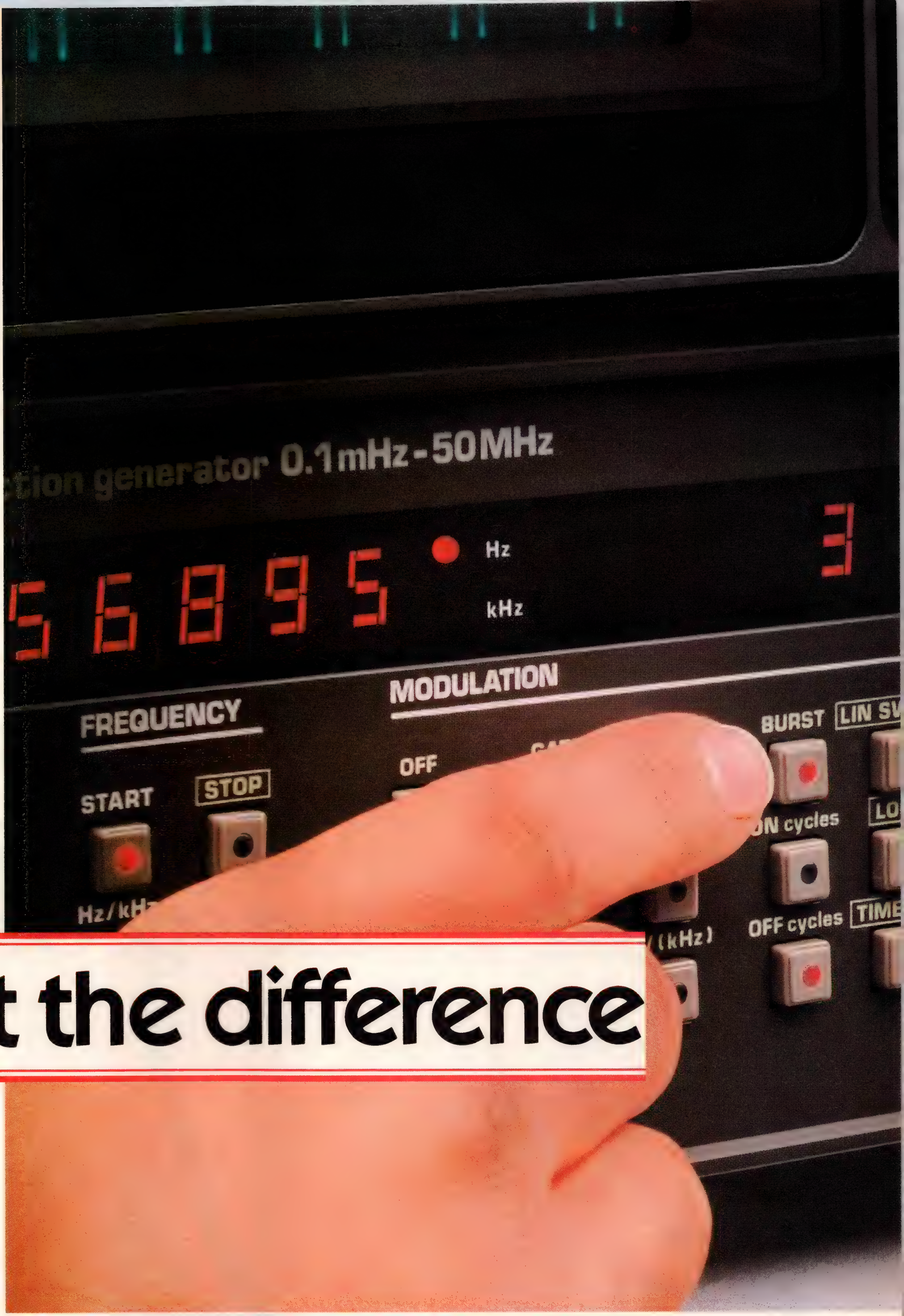
Philips proves that high performance doesn't necessarily mean high price. he PM 5193 is the most competitively-riced full-function 50 MHz-generator n the market. Yet it outperforms the ost expensive.

Just look at these features:

Extremely high accuracy thanks to 8-digit resolution and crystal oscillator reference over the range 0.1 mHz to 50 MHz.

Multi-function capability. Eight selectable waveforms (including 3 ns-Pulse and Haversine) and 5 modulation modes: AM / FM / Sweep / Burst / Gating.

Optimum programmability. IEEE compatibility enables full remote control operation in automated system environments.



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Test & Measurement

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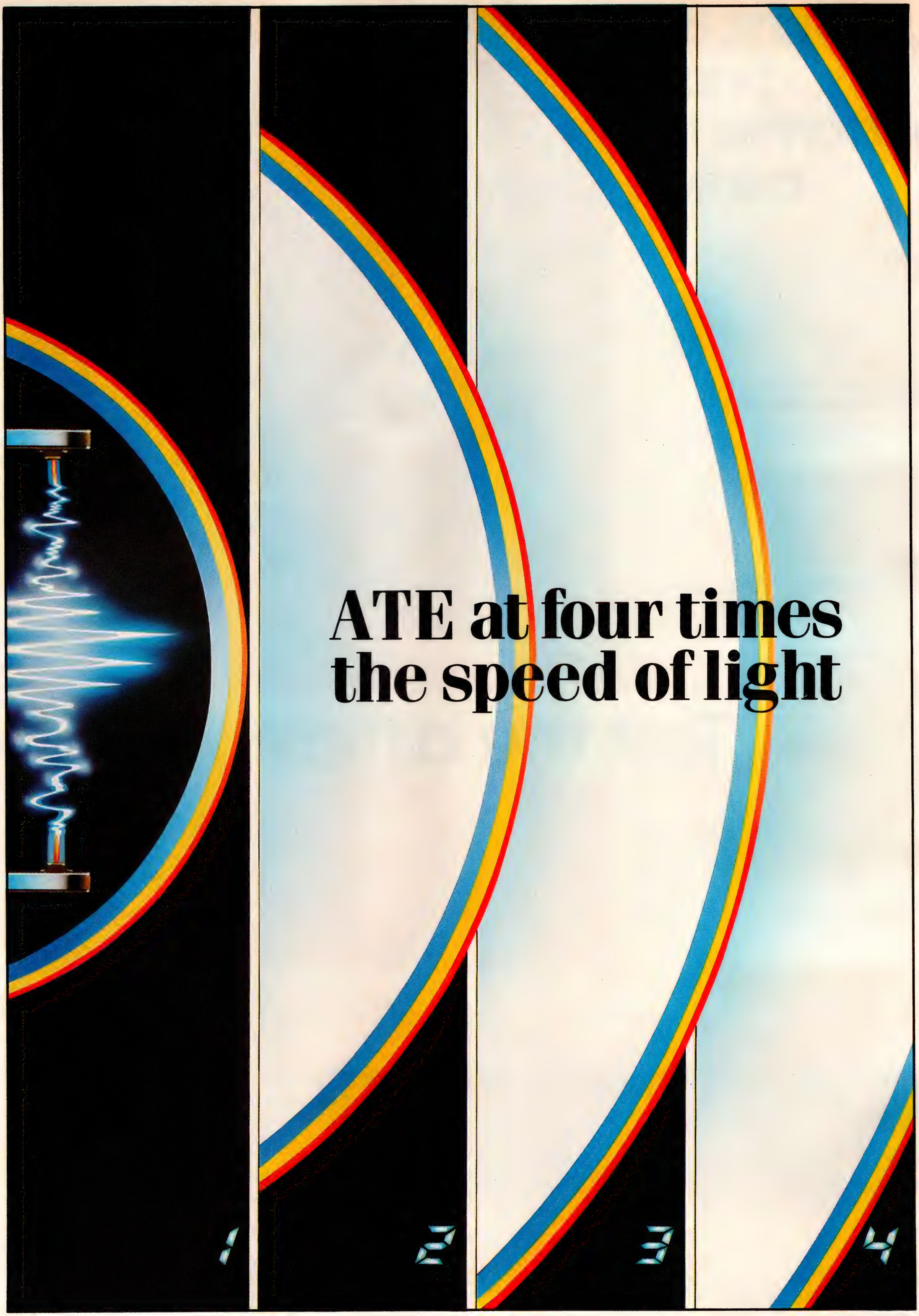
CIRCLE NO 109



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So fast, it catches the edge of light not once, but four times.

Imagine sitting in a totally darkened room with these pages open in front of you. Now switch on the light.

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There is only **one** cost effective way to test today's fast boards. At full operating speed. And with **30 MHz performance/10 MHz in-circuit** data rates plus **200 picosecond resolution (200 picoseconds ≙ 2.5″ (6 cms) at the speed of light).** There's only one system capable of testing at full speed – **Series 700.**

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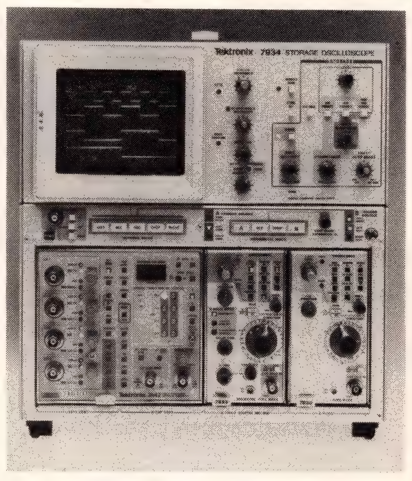


STORAGE SCOPE

The Model 7934 analog-storage oscilloscope has a 4-cm/nsec stored writing rate. This rate allows you to store single-shot events with rise times as fast as 700 psec. The scope's mainframe accepts as many as four of the company's 7000 Series plug-ins. The scope can display four channels at once.

The scope has 10 storage modes, including bistable, variable-persistence, fast-bistable, and fast variable-persistence storage. When not storing, the scope functions as a conventional 500-MHz instrument with a rise time of 700 psec.

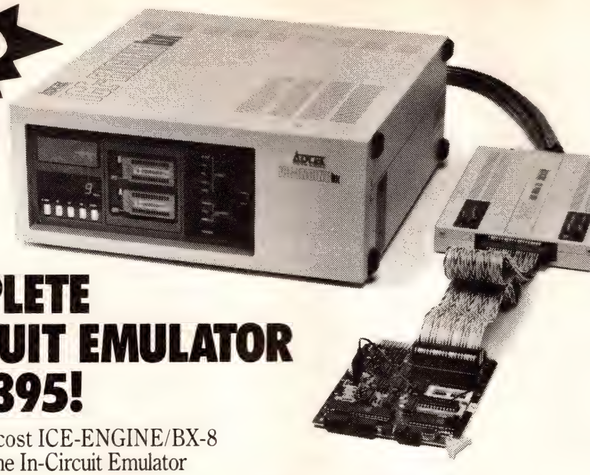
The graticule divisions of the scope's 8×10-division CRT measure 0.9 cm/div (0.45 cm/div in the reduced mode). The unit comes with a 3-pronged connector for scope-camera power. Scope with 500-MHz vertical amplifier and a dual-time-base plug-in, $20,355.

Tektronix Inc, Marketing Communications Dept, Box 1700, Beaverton, OR 97077. Phone (800) 547-1512; in OR, (800) 452-1877.

Circle No 621

DEVICE PROGRAMMER

Both S125-L and S125-GL programmers handle more than 800 devices, including PROMs, EPROMs, EEPROMs, single-chip μPs, and PLDs. Both program MOS devices without additional equipment; PLDs and bipolar PROMs require an adapter.



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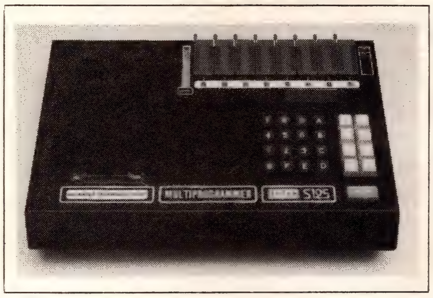

Each device has a 25-key, full-travel keyboard, 16-character×2-line LCD, 64k×8-bit RAM, an RS-232C port, and Centronics printer port. The S125-L features two zero-insertion-force sockets; the S125-GL has eight. An optional ROM-emulation module is available. The units' RS-232C ports handle 12 data formats including ones from Intel, Motorola, and Tektronix. With optional software, you can control the programmer from an IBM PC. S125-L, $1295; S125-GL, $1495; software, $195.

Bytek Corp, Instrument Systems Div, 1021 S Rogers Circle, Boca Raton, FL 33431. Phone (305) 994-3520.

Circle No 622

8051 EMULATOR

The SBE-51 supports the entire 8051 single-chip µP family, including the 8051, 8052, 8059 (plus CMOS versions) with 16-MHz real-time emulation, 16k bytes of program memory, 256 bytes of internal data memory, 500 cycles of real-time trace, and five hardware breakpoints. Other features include an RS-232C interface, a symbolic debugger for programs written in PL/M-51, and both an in-line assembler and disassembler. The company supplies a relocatable, macro cross-

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But Gould doesn't stop here. Many other advanced features make the 4050 an excellent bench instrument. And with its onboard IEEE 488 interface, you can even automate your testing.

For more information or a demonstration, write Gould Inc., Recording Systems Division, 3631 Perkins Avenue, Cleveland, OH 44114. Or in the U.S. and Canada, *call 1-800-447-4700, Operator 100.*

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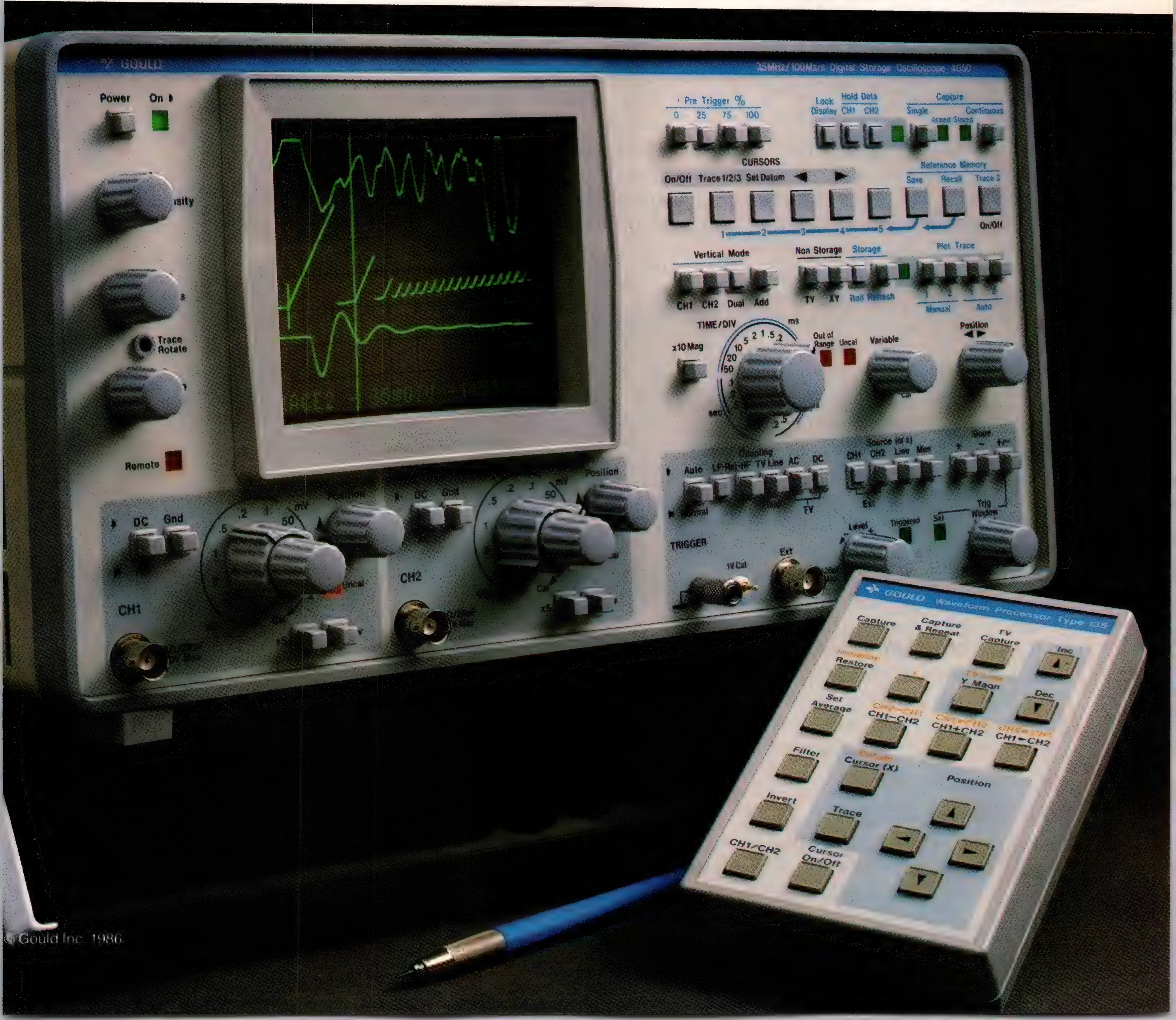
GOULD
35MHz/100MS/s Digital Storage Oscilloscope 4050
GOULD Waveform Processor Type 135

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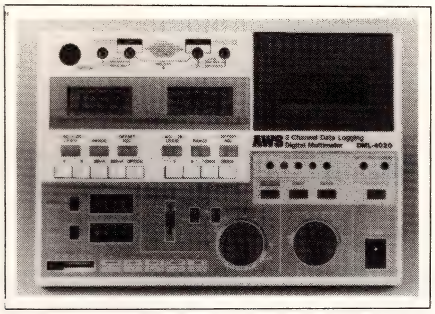
assembler and symbolic debugger for the IBM PC and CP/M systems. Support software is available for Intel Isis systems or the IBM PC. SBE-51 and software, $3495.

Huntsville Microsystems Inc, Box 12415, Huntsville, AL 35802. Phone (205) 881-6005. TWX 510-600-8258.

Circle No 624



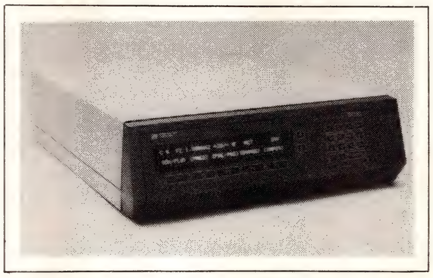
LOGGING MULTIMETER

The DML-4020 comprises two 3½-digit, autoranging, digital multimeters and a data-logging dot-matrix printer. You can use the two multimeters individually or simultaneously to display similar or dissimilar functions. With the unit's built-in comparator, you can set high and low limits. You can also print out a combined graphical and numerical readout showing the highest and lowest values measured, number of samples, and average of readings.

The instrument samples at rates ranging from every 5 sec to once per hour. It can make readings for periods as long as 30 days. The instrument measures 10.2×7×1.8 in. and weighs 39 oz. Its rechargeable NiCd battery comes with a charger. The carrying case is optional. $1000.

A W Sperry Instruments Inc, 245 Marcus Blvd, Hauppauge, NY 11788. Phone (800) 645-5398; in NY and AK, (516) 231-7050 (collect). TLX 645104.

Circle No 625

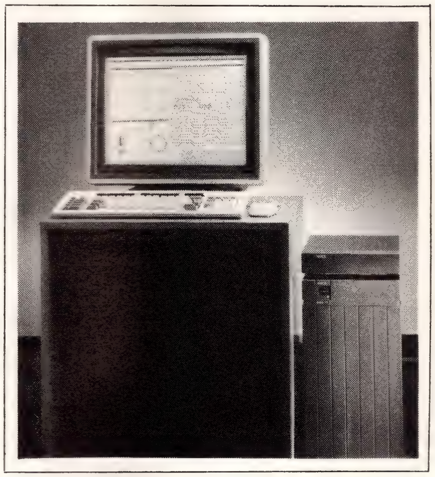


PROGRAMMABLE FILTER

You can tune the Model 9016 16-channel filter over a frequency range of 0.1 Hz to 100 kHz to 3-digit resolution and program as many as eight configurations of five parameters. The unit has an internal controller card with battery-backed RAM that can save eight combinations of filter frequency, pregain, postgain, signal routing, and analog input configuration (single-ended or differential) for each of the 16 channels. Plug-in filter cards include an 8-pole, Butterworth lowpass filter; 8-pole, 6-zero Cauer elliptic lowpass filter; 8-pole Bessel lowpass filter; and an 8-pole 6-zero constant-delay lowpass filter. An IEEE-488 interface is optional. $3500; with IEEE-488 interface, $4000; filter cards, $800 to $950 each.

Frequency Devices, 25 Locust St, Haverhill, MA 01830. Phone (617) 374-0761. TWX 710-347-0314.

Circle No 626



CAE WORKSTATION

The 6085 Expert Designer Workstation runs software for automated pc-board design and layout, logic design and simulation, mechanical drafting, and technical publishing. It also runs software written for the IBM PC concurrently with these programs. The workstation uses the Ethernet interface for networking.

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With SBM 383 subminiature connectors Siemens offers a wide range of economically priced products.

- A variety of applications

Applications for SBM 383 connectors are found in telecommunications, text and data processing, as well as in test engineering and instrumentation and control. They are employed as rack and panel connectors, cable connectors and equipment connectors.

- A variety of termination styles

The connectors are available with terminals for soldering, wave-soldering (straight and angled), insulation displacement and crimping.

SBM 383 connectors are compatible with all commercially available SBM connection systems and comply with the latest IEC draft standard 48B (Germany) 99 at requirement levels 2 and 3. With polyester as the insulation material, good temperature stability is achieved.

Should you wish further information, please write to Siemens AG, Infoservice 143/085, Postfach 2348, D-8510 Fürth.

A19100-N621-Z2-V1-7600

Electromechanical components from Siemens

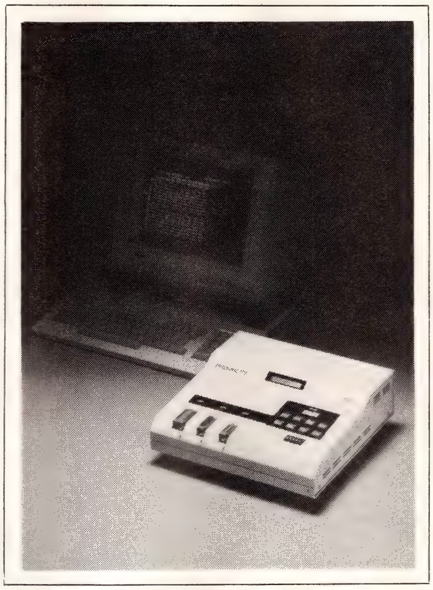
CIRCLE NO 125

Featuring a proprietary bit-slice processor, the unit has 1.1M to 3.7M bytes of main memory. It comes with a choice of a 15- or 19-in. monochrome, bit-mapped display. The 15-in. model provides a 697×880-pixel resolution at a 28-kHz scan rate. The 19-in. version offers a 925×1184-pixel resolution and a 37.28-kHz scan rate.

The standard workstation includes a 40M-byte hard-disk drive. (You can specify a 20M- or 80M-byte drive.) The standard system also comes with a 5¼-in. double-sided, double-density floppy-disk drive. An optional 80186-based pc board enables the workstation to run IBM PC programs. $8000 to $12,000, depending on display and memory sizes; software packages, $6500 to $32,000.

Xerox Corp, EIS Unit, 2945 Oakmead Village Ct, Santa Clara, CA 95051. Phone (408) 988-2800.

Circle No 634



PLD PROGRAMMER

The Promac P3 programmable-logic device (PLD) programmer works with most 20-, 24-, and 28-pin devices. The unit programs PALs, FPLAs, and EPLDs (MOS, CMOS, and ECL). It accepts standard JEDEC device files and can therefore work with PLD-programming languages like Abel and Cupl. The programmer also includes a resident Palasm assembler, which you can invoke only if you connect a dumb terminal to the programmer. In addition, the unit can also program a standard 256k-bit EPROM with a given PLD's JEDEC file, including pin assignments, equations, fuse pattern, and test vectors. The EPROM then serves as storage of the PLD's design. You can later reload the contents of the EPROM into the programmer to program additional PLDs. The programmer contains a separate 8k-byte nonvolatile RAM for fuse maps or test vectors. A 16-character LCD displays operator prompts. $2995.

Promac Programming Instruments, 2999 Monterey/Salinas Hwy, Monterey, CA 93940. Phone (408) 373-3607. TLX 882141.

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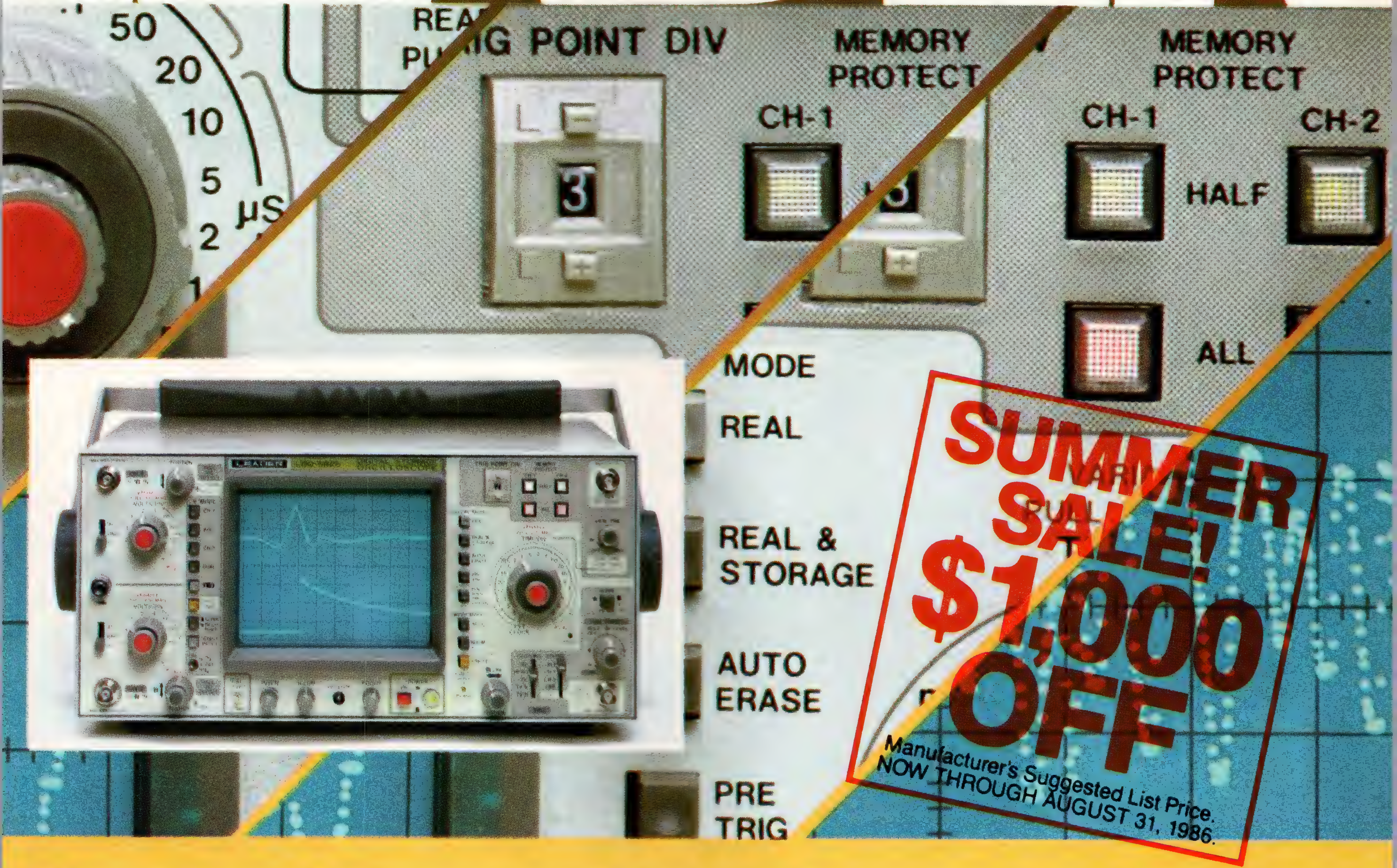

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No Longer an Ether/Or Question

Our new chip set gives you the flexibility of offering Cheapernet protocols too. Cheapernet uses lower-cost cable and connectors, and is easy to install. So your cost per connection can be driven down to roughly half that of Ethernet. Yet you don't have to trade off Ethernet's fast 10-megabit-per-second transfer rate.

Easy to Glue Together

To complete a LAN interface, this new chip set needs only a few additional components. The coax transceiver, for example, requires just one resistor, plus signal and power isolation. The serial interface utilizes a patented digital phase lock loop design that eliminates the need for precision analog components. And the controller chip itself incorporates two 16-bit DMA channels and buffer memory management functions, which reduce the network interfacing tasks of the host CPU.

Making the Right Connections

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CIRCLE NO 118

Eurocard computer packages and accessories *(Sarel Ltd)*

Eurocard packaging suits a wide range of plug-in modules

Peter Harold, *European Editor*

Eurocard mechanical standards let you implement modular electronic assemblies by using pc-board plug-ins from a variety of manufacturers. When you adopt a Eurocard-based system, you can choose from a wide variety of packaging components that are compatible both with the pc boards and with each other.

The Eurocard footprint for pc boards has become widespread, both in Europe and, more recently, in the US. In Europe, almost any plug-in board complies with Eurocard board dimensions. In the US, VME Bus and Multibus II products, as well as a growing number of other products, use the Eurocard format. As a result, the mechanical packaging available for these boards is also highly standardized. You can purchase suitable Eurocard-compatible mounting hardware and enclosures from a variety of vendors, safe in the knowledge that you'll encounter few problems in assembling your equipment. In fact, although such a high degree of standardization makes many of the products look-alikes, you can find special products that offer ruggedized assemblies, enhanced RFI shielding, or special case styling.

The specifications for the Eurocard packaging system are embodied in the DIN-41494 and IEC-297 standards (**Ref 1**), on which the IEEE's P1101 committee will base an IEEE standard. A Eurocard packaging system, which is designed to fit into 19-in. racks (see **box,** "19-in. rack dimensions suit Eurocard boards"), consists of several levels of integration, including simple Eurocard-footprint pc boards, plug-in units containing one or more Eurocard boards, and subracks (card cages) that accept the plug-in units.

Subrack systems typically comprise two flanged end-plates connected at the front and rear by horizontal crossbars. A subrack assembly slides into the front-panel aperture of a standard 19-in. rack. Holes in the crossbars on a 0.2-in. pitch allow you to mount a variety of mounting and connector assemblies, including horizontal card guides, vertical divider kits, and backplane assemblies, between the crossbars. On 6U and 9U (10.5- and 15.75-in.) subracks, alternative mounting holes in the end plates allow you to position the crossbars to accommodate single-, double- or triple-height Eurocards. In subracks with sufficient depth, you can also position the crossbars to support standard, extended, or hyper-extended Eurocards.

The simplest plug-in assembly that the subrack accepts is a Eurocard pc board. Often, a pc board comes

In the US, VME Bus and Multibus II products, as well as a growing number of other products, use the Eurocard format.

attached to a narrow front panel equipped with retaining screws so that you can insert or withdraw the board from the subrack without having to remove the entire 19-in. front panel.

If a single functional module within your system requires more electronics than a single pc board can accommodate, you can put the functional module inside a Eurocard plug-in module or a cassette. Although many plug-in modules have internal card guides for Eurocards, within a plug-in module you're free to choose any mechanical layout. You don't, for instance, need to use a pc board in the module. You can mount large or heavy components, such as power transformers, which you wouldn't normally mount on a pc board,

19-in. rack dimensions suit Eurocard boards

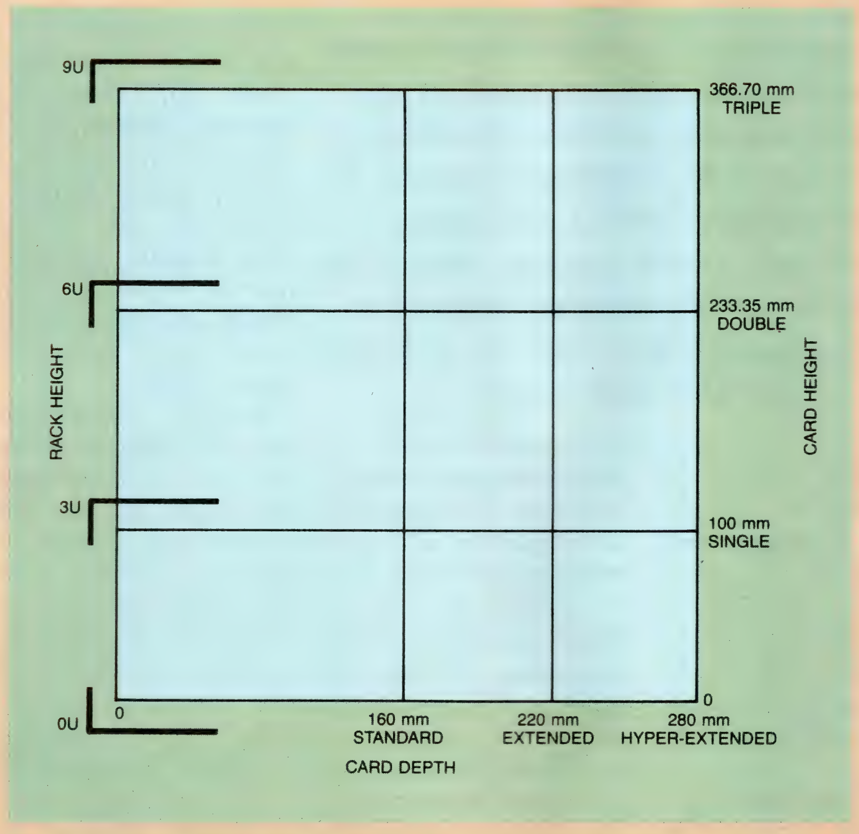
The Eurocard packaging system is a dimensional hybrid between the metric measurements (100×160 mm) of a standard-depth single-Eurocard board and the imperial measurements (19 in.) of a standard rack.

The standard height increment for the 19-in. racks is 1.75 in. (44.45 mm), which is defined as 1U. Therefore, to accommodate a single Eurocard, you need at least a 3U rack, which has an internal capacity of 133.35 mm—100 mm for the Eurocard and approximately 16.6 mm above and below the card for the subrack's mounting rails and card guides. As you can see from **Fig A,** a double Eurocard (233.35 mm) requires a 6U rack, and a triple Eurocard (366.70 mm) needs a 9U rack.

The incremental increase in depth of the Eurocard is standardized at 60 mm; 19-in. racks can accommodate 160-mm standard, 220-mm extended, and 280-mm hyper-extended Eurocards.

The front-panel aperture of the 19-in. rack is divided into a basic unit of 0.2 in. (5.08 mm), which is defined as 1T (or 1 HP). Although the standard allows for a minimum front-panel width of 1T for a plug-in unit, this width is impractical for anything other than a blanking plate. Because of the pc board's thickness and the mounting height of components, the minimum practical width for a pc-board plug-in unit is 3T; plug-in modules and cassettes often extend to widths of as much as 28T or even 42T.

Finally, Eurocard pc boards almost universally employ DIN-41612 standard indirect edge connectors, which fit between the pc boards and the backplane wiring. All DIN-41612 connectors have identical mounting dimensions, and they're available in a variety of pin configurations and contact types.



***Single, double, and triple Eurocards** are tailored to fit into 3U, 6U, and 9U versions of a standard 19-in. rack. Eurocards come in three card depths from 160 mm to 280 mm.*

in the module. For example, the range of single-Eurocard plug-in modules from Fischer Metroplast includes versions with finned heatsinking side-panel extrusions, which allow you to mount power components on the inside wall of the plug-in module or on a flat surface between the fins on the outside of the plug-in module.

Cassettes are designed to carry Eurocard plug-in pc boards of exactly the same type you would use directly in a subrack, but the cassettes allow you to insert or withdraw the multiple-pc-board subsystem in a single operation. A cassette can even carry its own section of backplane so that its pc boards remain electrically connected (for test and repair purposes) even after the cassette is withdrawn from the subrack.

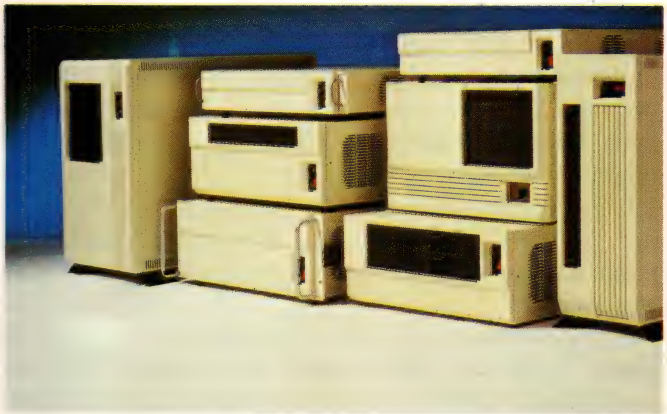
One advantage of using plug-in modules or cassettes is that they can provide local RFI shielding of critical circuitry, possibly saving you the cost of an expensive RFI-shielded enclosure. Note, however, that you must decouple the input and output connections of the plug-in module or cassette to prevent them from acting as an interference pathway.

Priced from around DM 50, Telemeter Electronic's EK Series 8T-wide (1.6 in.) Eurocard plug-in modules feature a seamless aluminum body-shell extrusion with bolt-on front and back panels. They provide a high degree of RFI shielding.

Fischer Metroplast's EHF single-Eurocard plug-in modules are also optimized for RFI shielding. Each module comprises a 2-part body shell with wide overlapping joints and bolt-on front and rear panels. The matte etched aluminum finish doesn't hinder RFI shielding. You can combine any two of the three basic body shell extrusions to produce plug-in module widths of 10T, 12T, 14T, 19T, 21T, or 28T. Prices for EHF Series modules range from DM 13.8 to DM 29.8 (100).

Unless you require such special modules, you'll find you can obtain the DIN-41494/IEC-297 subracks, single pc-board plug-in accessories, plug-in modules, and cassettes that you need from almost any one manufacturer, although many companies offer compatible products. For the basic structure (flanged end plates plus front and rear crossbars) of a 3U-high, 19-in. subrack you can expect to pay as little as £14. Front-panel kits for single pc-board plug-ins cost from about £1.50 to £6 depending on height and width. Typical plug-in modules cost between £5 and £25, and cassettes sell from £15 to £25. These prices don't include connector costs, however.

Eurocard packaging components are commonly made of aluminum or aluminum alloys. The surface treat-



Desktop and vertical-tower VME Bus packages *(Electronic Solutions)*

Front-panel board-ejector handles *(Scanbe)*

Fully integrated 20-slot VME Bus package *(BICC-Vero Electronics Ltd)*

A pc board often comes attached to a narrow, screw-in front panel, so you can withdraw the board from the subrack without removing the entire 19-in. front panel.

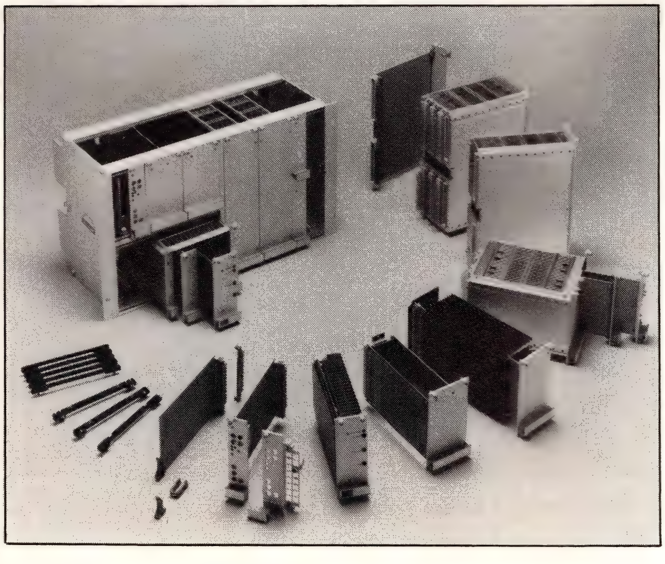
ments used to protect the aluminum from corrosion may differ, however. The most common treatment for aluminum is anodizing. Although it provides a high degree of corrosion resistance and good visual appearance, anodizing has the disadvantage of rendering the aluminum surface nonconductive. In fact, unless the jointing method between the components of the package punctures the anodizing, the package might not exhibit the electrical continuity required for adequate grounding.

Furthermore, this nonconductivity in the joints is likely to be far more critical for systems that are susceptible to RFI, because they rely on the electrical continuity between overlapping metal surfaces to provide an effective RFI shield. To provide a conductive surface, several manufacturers offer other surface treatments—for example, a clear, chromate conversion (irridite) coating—to special order. For all of Mupac Corp's subracks, a clear irridite coating is standard; Schroff's Europac range of subrack components has a conductive Aludine finish, which ensures adequate grounding.

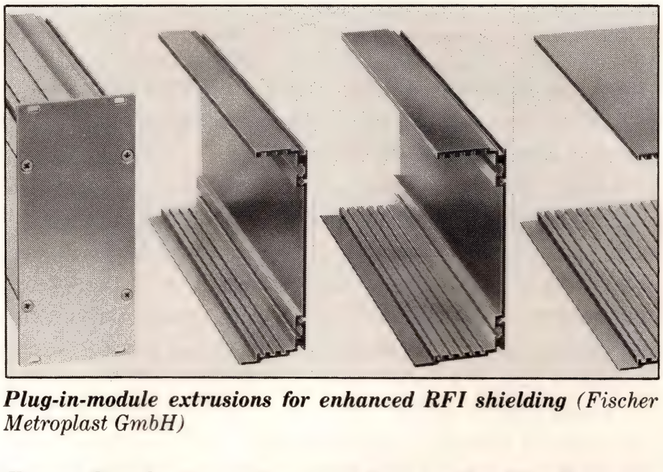
Although standard aluminum parts suit most industrial applications, some manufacturers provide assemblies with enhanced rigidity and performance under vibration. For example, BICC-Vero Electronics offers its KM6 range of subracks in three grades. In addition to the standard and universal versions, the company provides a heavy-duty aluminum version that meets shock and vibration standards as specified by DEF 07-55 part II, IEC 68-2 test FC, BS 2011 part II IFC, and DIN 40046 parts 7 and 8. The heavy-duty components cost about 50% more than do parts in the standard range. Rittal's Uniset subrack systems, which feature heavy-duty die-cast aluminum side panels, are shock and vibration tested to DIN-40046 standards.

You can also obtain packaging components in materials other than aluminum. For instance, the Normapack range of subracks, plug-in modules, and accessories from Ganzerli is manufactured from galvanized sheet steel. Transrack's Challenger I is an entire subrack assembly made of flame-retardant Noryl plastic and polycarbonate. Available in heights of 3U or 6U and accommodating standard 160-mm-deep Eurocards, the Challenger I subrack clips together without screws; it has integral card guides molded into the top and bottom sections to provide board pitches of 0.6 in. or 0.8 in. The subrack is suitable for single pc-board plug-ins, but you have to replace the top and bottom sections with conventional crossbar extrusions and card guides if you want to accommodate plug-in modules or cassettes. Prices for the all-plastic versions of Challenger I subracks start at around Fr fr 188.

Most manufacturers supply various horizontal and vertical divider kits that allow you to accommodate various sizes of Eurocard within a single subrack. You can also find many other mounting accessories that assist in the assembly and performance of your Eurocard system. Elrack, for example, supplies card guides that extend beyond a subrack's rear crossbar, providing clip-in mounting of DIN-41612 connectors. When you're not using connectors that are premounted onto a backplane, you can use these guides to assemble the connectors easily. An additional advantage of the guides is



Eurocard packaging system, including a subrack and plug-ins such as pc boards, plug-in modules, and cassettes *(Schroff GmbH)*



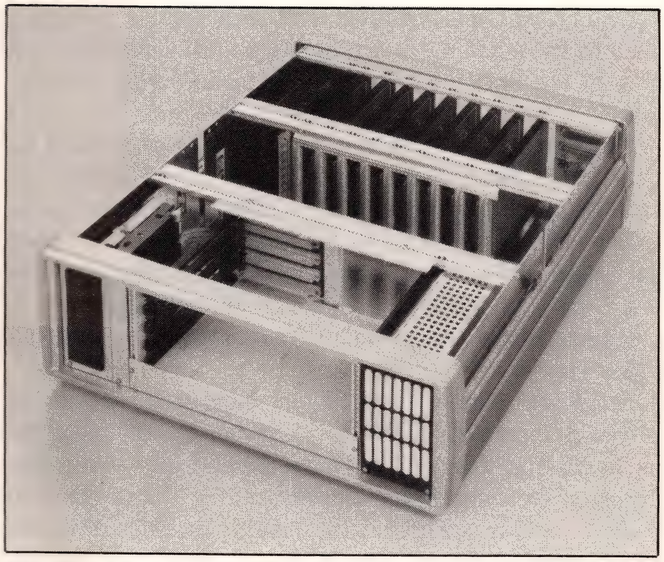
Plug-in-module extrusions for enhanced RFI shielding *(Fischer Metroplast GmbH)* that they prevent any misalignment (which may happen during assembly) between the pc-board connector and the subrack connector.

If the 96 pins available on a 3-row DIN-41612 connector don't satisfy your board-interconnection requirements, you can use BICC-Vero's KM6 Databus system, which provides you with as many as 64 additional backplane connections positioned along the two card-guide edges of a 160-mm-deep Eurocard. Arranged in groups of 16, the backplane connections and their associated vertical finger connectors clip to the backs of standard card guides. Special pc-board-mounted indirect edge connectors slide past the backplane's finger connectors as you insert the board into the subrack; a molded cam on each connector prevents the contacts from mating until the board is correctly positioned. A 20-slot, 16-way backplane costs £8; you'll spend an additional £4 in connector costs for each pc board you couple to the backplane.

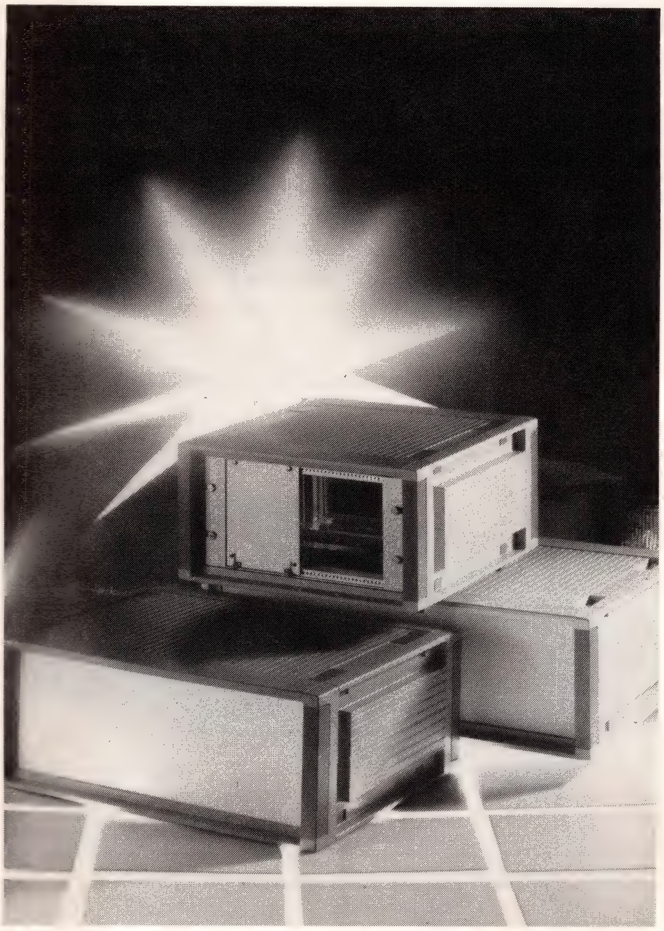
Finally, if you've ever experienced difficulty in removing Eurocard plug-ins (especially those fitted with two 96-pin DIN-41612 connectors) from a subrack, consider using Scanbe Corp's E-Z-Ject front-panel handles, which are consistent in appearance with the front-panel handles typically used on VME Bus plug-ins. The E-Z-Ject handles pivot through a hole in the front panel to provide leverage directly between the plug-in's pc board and the subrack's crossbar assembly, so they let you remove the plug-in easily. The company supplies E-Z-Ject handles in kit form at prices from \$3.05 to \$5.40 for 3U, 6U, and 9U front panels. It can also provide blank or custom silkscreened front panels that are preassembled with E-Z-Ject handles.

Although the DIN and IEC standards are geared to vertically mounted single-height Eurocards in 3U enclosures and double-height Eurocards in 6U enclosures, several manufacturers (including BICC-Vero, Elma, Imhof-Bedco, Sarel, and Schroff) let you mount double-height Eurocards horizontally in a 3U enclosure. The 3U height is a particular advantage for designers who need a low case profile—for example, for desktop equipment. These vendors provide special mounting kits that adapt their subracks for the horizontal mounting of double Eurocards; the card guides are mounted on the subrack's side walls or vertical dividers.

If you mount double Eurocards horizontally in a 19-in. subrack, you'll still have enough space adjacent to the cards to mount 5¼-in. modules, such as floppy-disk, Winchester, or tape drives. Note, however, that horizontally mounted cards hinder natural convection cool-



3U subrack and case with horizontally mounted double Eurocards *(Elma Electronic AG)*



Plastic desktop cases *(Bundoplast-bopla GmbH)*

If a functional module in your system needs more electronics than a single board can accommodate, you can put the module into a Eurocard cassette or plug-in module.

ing, so hot spots may remain on the pc boards. You may need to use some of the extra space in the subrack for a plug-in fan unit that can provide forced cross ventilation.

Eurocard packaging has traditionally been used in tall, 19-in. racks and cabinets, usually for industrial-automation purposes. But Eurocard packaging is also suitable for use in desktop equipment. Eurocard-based backplane-bus computer systems, for instance (such as VME Bus, STE Bus, G64/G96 Bus, and Multibus II systems), often require software development on desktop systems.

Although you can use most Eurocard packaging products internally in desktop equipment, the external packages for such equipment are generally somewhat different from the industrial enclosures. For a desktop system, which you'll probably use in an office environment, case styling and color are as important as the considerations of structural rigidity, environmental sealing, and RFI shielding.

For desktop equipment, many manufacturers produce 19-in. cases that accept 3U, 6U, or 9U subracks. These somewhat utilitarian enclosures typically have pressed steel or aluminum top and bottom covers and a range of extruded or die-cast aluminum side walls that let you adjust the enclosure to the appropriate height.

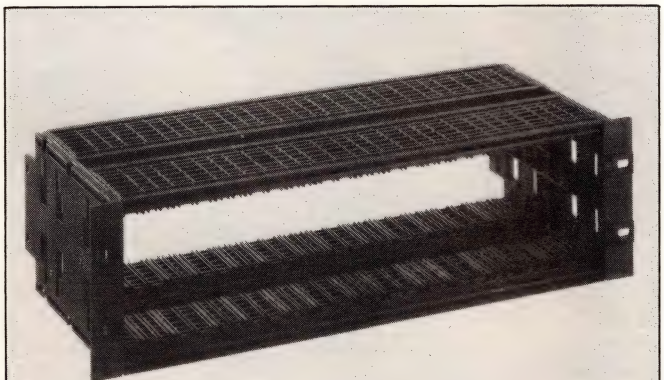
Some manufacturers make their metal cases more appealing to the eye by softening the edges of the front panel aperture with a molded bezel. This technique is employed to good effect in BICC-Vero's Diplomat cases, Schroff's Comptec and Compac cases, Elma's Type-32 cases, Sarel's Solidus cases, Feltron Zeissler's Cardbox cases, and cases from Heidenreich GmbH. BICC-Vero's Diplomat cases include additional bezel sections that obscure the mounting bolts holding the subrack in the case. Depending on size, typical metallic enclosures range in price from around £20 to £120.

Plastic enclosures

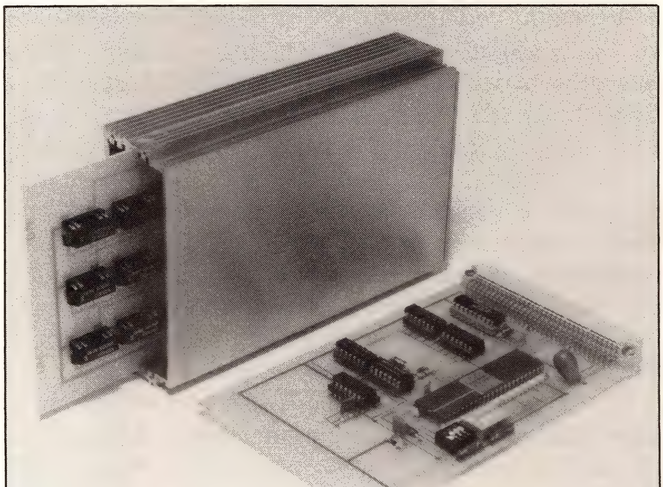
Other companies offer plastic cases. The manufacturers use modern plastics and injection-molding techniques to sculpt the entire surface of the cases, giving them such features as front- and rear-panel bezels, surface texturing, carry handles, ventilation slots, grooves for sealing gaskets, and internal mounting points.

The Titan 19-in. cases from BICC-Vero, for example, are manufactured from self-extinguishing ABS plastic with a flame class rating to UL94-V0. The cases have identical top and bottom moldings; side moldings let you construct a case of any height between 3U and 12U. The case is reversible (front to rear) and allows for alternative chassis-assembly techniques on these faces. On one face, you can place standard 19-in. mounting rails in molded-in slots, so you can screw-mount standard subracks. On the other face, a narrower aperture and molding allow you to drop standard subracks directly into a mounting slot without screws. Vertical-tower versions are available in 3U, 4U, and 6U sizes. The Titan cases range in price from around £59 to £124.

Priced from DM 150 and DM 250, Bundoplast-bopla's Internorm-19 plastic cases comprise top and bottom sections with side infill moldings that let you produce case heights from 3U to 6U. Eight screws hold the case

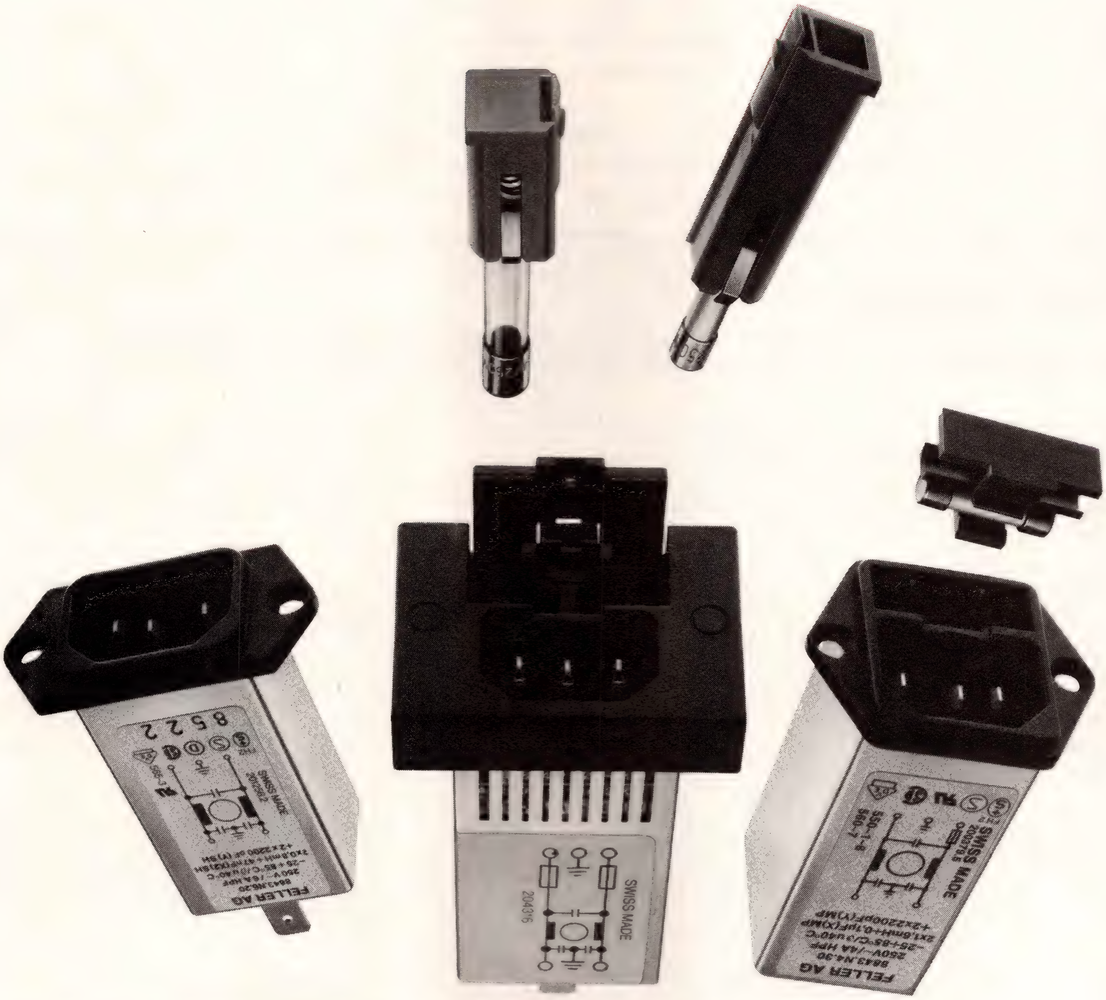


Subrack made of Noryl and polycarbonate *(Transrack)*



Seamless plug-in-module extrusion *(Telemeter Electronic GmbH)*

Feller filters will solve your EMC problems



Klöti USC

The EMC filters developed and manufactured by Feller safeguard a wide variety of electronic circuits. The advantages of these EMC filters include simple integration in your products because of compact dimensions and dependable operation in a broad frequency range.

Feller Universal Combicon Filters, for example, feature two color-coded fuse holders for U.S. or European fuses (this allows you to incorporate "exportability" into the basic design of your products and to equip them with the corresponding fuses and cord-sets prior to shipment).

Feller's vast product line also includes EMC filters with single-pole fuse holders or other specific features. And because each country issues its own electrical prescriptions, all Feller EMC filters display the most important international approvals.

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CIRCLE NO 119

Although many plug-in modules have internal card guides for Eurocards, within a plug-in module you're free to choose any mechanical layout.

assembly together. Plastic insert moldings cover the screw heads and act as feet on the bottom section. You can insert rails for screw-mounting 19-in. subracks, or you can insert plain front and rear panels in premolded slots. Sealing gaskets let you seal the case to IP54 (International Protection) standard. Elrack and Imhof-Bedco also manufacture 19-in. plastic cases.

Besides their good appearance, plastic cases provide equipment users with a degree of electrical-shock protection in the event of faulty equipment grounding. Further, the cases often have plastic moldings of the same color, so that surface scratches have little effect on the cases' appearance.

Plastic cases don't, however, provide the RFI shielding that's inherent in metal case assemblies. To provide such shielding for a plastic case, most manufacturers will coat the internal walls of the case with a conductive material, usually a nickel-loaded paint. If you wish to apply the coating yourself, you can use a nickel screening compound. Electrolube (Wargrave, UK) offers the

For more information . . .

For more information on the Eurocard packaging products described in this article, circle the appropriate numbers on the Information Retrieval Service card or contact the following manufacturers directly.

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Imhof-Bedco Standard Products Ltd
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Rittal Ltd
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Total Timing Accuracy ±500 ps
Timing Generator 46 edges max.
Pattern Memory 512 k words max.
Algorithmic Pattern Generator*
14X, 14Y, 18 data
Serial Pattern Generator*
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DC Measurement Universal type; 16 units/station; PMU/pin
Parallel Testing Available

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CIRCLE NO 120

Cassettes allow you to insert or withdraw the multiple-pc-board subsystem in a single operation.

compound in a 200-ml aerosol can for £6.50. If your equipment's performance depends on the effectiveness of your RFI shielding material, however, make sure that the coating is resistant to flaking and abrasion and that it will last for the life of the product.

Although most manufacturers of electronic-equipment packaging offer purely mechanical assemblies, some have begun to produce fully wired enclosures for the Eurocard-based VME Bus and Multibus II systems. These packages come complete with backplanes, power supplies, and cooling fans. BICC-Vero, for instance, offers the desktop VME Bus Microrack-10/10 and -20/20, which are probably the only off-the-shelf versions of this type of enclosure. The company also manufactures such enclosures to custom requirements.

Based on the company's Diplomat range of metal enclosures, the Microracks incorporate a plinth in the base which, in addition to housing the cooling fans, also carries power and reset switches, as well as LED indicators for the 5V and ±12V power rails and for the system-fail status. You merely insert a suitable set of VME Bus boards to have an electrically functional system. The £1740 Microrack 10/10 has 10-slot J1 and J2 backplanes, which leave enough adjacent space for the mounting of disk drives. The full width of the £1790 Microrack 20/20 is occupied by a 20-slot J1 backplane. VME Bus Microracks are also available in 3U and 9U heights and in rack-mount versions. A Microrack is available for Multibus II systems.

Schroff's 3U Compac and 6U Comptec VME Bus packages and Sarel's range of VME Bus and STE Bus Xixin Micro Mainframe enclosures provide a modular approach to the production of fully integrated enclosures for VME Bus and STD Bus systems. Schroff offers a selection of compatible components, including backplanes, power supplies, disk-drive cassettes, and blanking and connector-mounting panels. The company assembles the components for you in a case that's prewired with line-input connectors and cooling fans. The 3U-high Compac package supports double Eurocards mounted horizontally; the 6U Comptec package has a conventional subrack assembly. Sarel's Xixin Micro Mainframe enclosures come in similar configurations.

Enclosures look like PCs

If you want your VME Bus system enclosure to look different from the usual 19-in. case, consider using a VME system enclosure from Electronic Solutions. The Eurocard subrack, along with the power supply and cooling fans, is hidden away inside the enclosure in the form of an independently mounted double-Eurocard-size card cage. Each slot of the cage also accepts two single Eurocards when you employ a special center-adapter kit.

The enclosures look more like desktop personal computers than 19-in. cases. Their only accessible front-panel components are the disk drives, the power switch, and the reset button. The packages, priced between $1420 and $3280, range from a 3-slot to a 12-slot model, and they include desktop enclosures, floor-standing towers, and rack-mount units. You can also expect Schroff, Sarel, and Electronic Solutions to offer similar Multibus II packages in the near future. Siemens, as well, will offer a Multibus II enclosure that includes the company's ES902C-series subrack assemblies, which have supported its Eurocard-based AMS Bus and SMP Bus computer products for several years. **EDN**

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2. Hesse, Dirk, *The Connector Family and the Modular 19-in. System for Mechanical Structures of Electronic Equipment*, Markt & Technik, Haar by Munich, West Germany.

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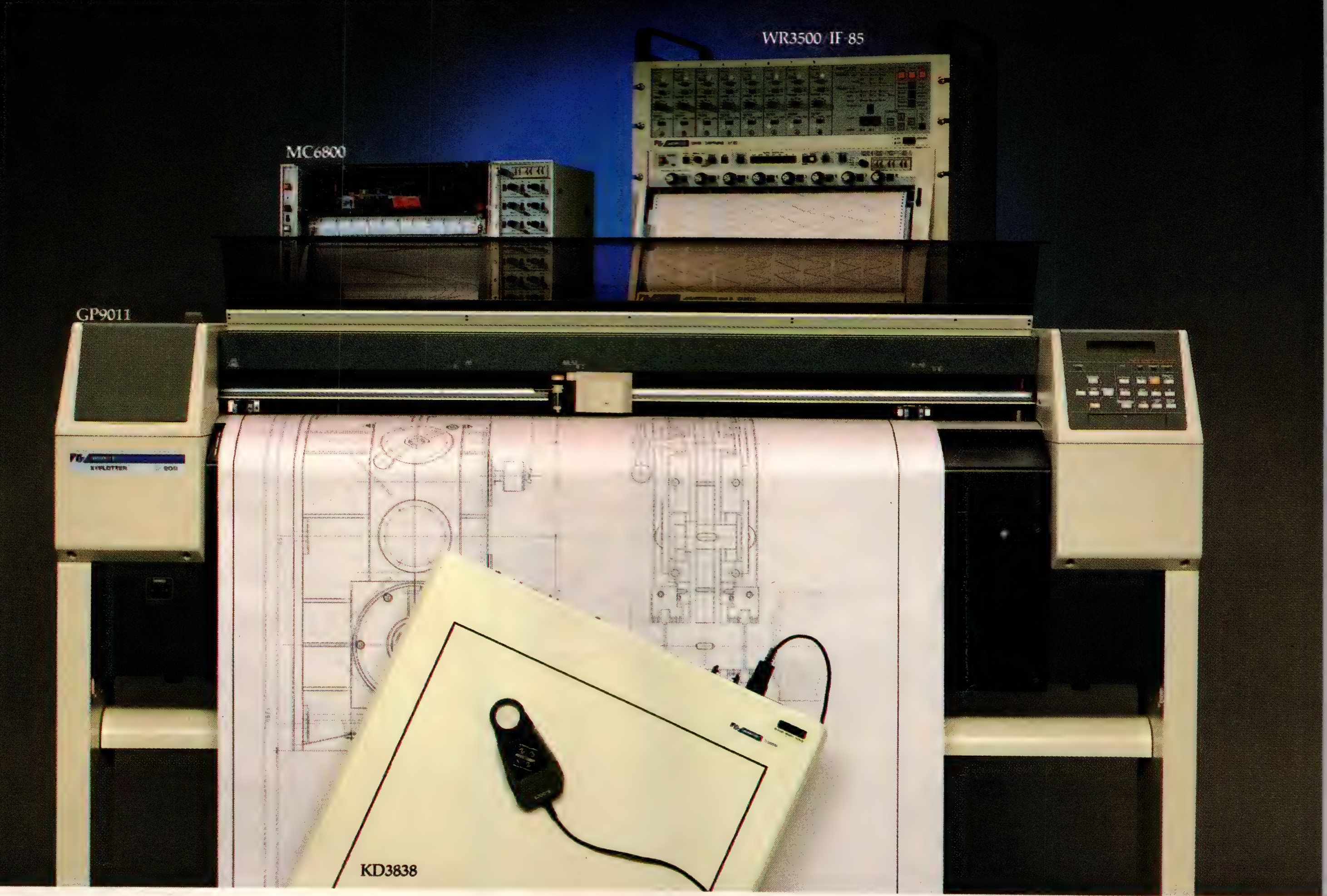

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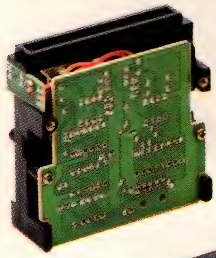
Communication mode	Start-stop synchronization, full duplex (half duplex)	Start-stop synchronization, full duplex
Transmission speed (baud)	1,200/2,400/4,800/9,600	1,200
Communication format	Start bit 1 Data bit 8 Parity (even) 1 Stop bit 1	
Card driving system	Motorized	Manual
Performance	Read/write	Read only

Applicable Magnetic Card

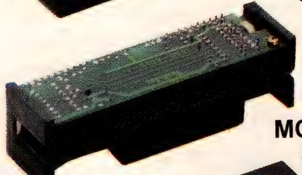
Type	Card Standard
MCS-111, 121, 131 MCI-111	ISO, track 2
MCS-112, 122, 132 MCI-112	ISO, track 1
MCS-113, 123, 133 MCI-113	ISO, track 3

Card Reader Units



MCI-110 Series

MCS-110 Series



MCS-120 Series

MCS-130 Series

Tokin

Tokin Corporation

Head Office: Hazama Bldg., 5-8, Ni-chome,
Kita-aoyama, Minato-ku, Tokyo 107, Japan
Tel.: Tokyo (03) 402-6166 Telex: 02422695 TOKIN J

Tokin America Inc.
2261 Fortune Drive, San Jose, California 95131
U.S.A. Tel.: 408-946-4887

You can reach our agents by phone:
London 01-837 2701; Paris 1-45 34 75 35;
Milan (0331) 678.058; Munich (089) 5164-0;
Seoul (02) 777-5767; Taipei (02) 7311425;
Hong Kong 3-315769; Singapore 747-8668;
Sydney (2) 922-7566

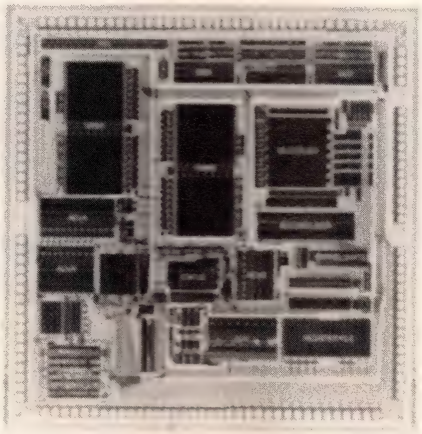
CIRCLE NO 122

DSP chip uses parallel processing to compute 48M operations/sec

The PCB5010 and PCB5011 CMOS DSP ICs allow you to execute six internal operations in parallel, achieving an effective speed of 48 MOPS. The PCB5010 contains mask-programmable program and data ROMs; the ROMless PCB5011 interfaces to external memory.

The ICs' 16×16 multiplier produces a 32-bit result, which you can add to or subtract from a 40-bit accumulator. To support multiple-precision operations, you can divide the accumulator by 2^{15} before this addition or subtraction. An output barrel-shifter allows you to extract a 32-bit word from one of 16 positions in the accumulator, and you can alter the format of the 32-bit word's 16 LSBs.

The 2-operand 16-bit ALU and 15 register files provide 31 instructions, several of which are suitable for multiple-precision calculation. You can load operand data directly into the ALU or use operands stored previously in its input latches.



Both devices contain two 128×16-bit data RAMs and associated address computation units. You can increase data RAM capacity to 64k×16 bits by adding RAM externally. You can send data I/O via a 16-bit parallel port, or you can transfer it via two serial I/O ports, which operate at speeds as fast as 4M bps. A separate address-computation unit addresses the data ROM. This ROM is a 512×16-bit on-chip ROM in the PCB5010; in the PCB5011, it consists of external memory accessed via a dedicated 16-bit I/O port.

The PCB5010 includes a 987×40-bit program ROM and a 32×40-bit program RAM. The PCB5011 directly accesses 1024 program instructions in external memory, expandable to 64k instructions.

PCB5011 samples, gld 500; the PCB5010 will be available in quantity in the 2nd quarter of 1987, with a projected 1989 price of under $20.

Philips, Elcoma Div, Box 523, 5600 AM Eindhoven, The Netherlands. Phone (040) 757005. TLX 51573.

Circle No 666

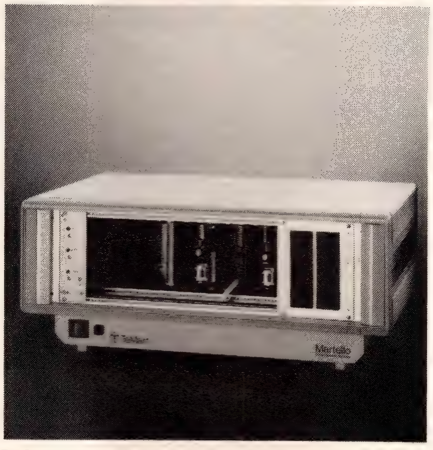
Signetics Corp, 811 E Arques Ave, Sunnyvale, CA 94086. Phone (408) 991-2000.

Circle No 667

STE-Bus development system runs the Forth programming language

Using the Martello development system, you can develop application software for STE Bus (IEEE P1000) systems by using the Forth programming language. You can extend Forth and tailor the language to suit your application, rather than being constrained by a strict set of programming commands.

The development system includes a 10-slot STE Bus backplane; two 1M-byte, 3½-in. disk drives; and a CPU card with a ROM-based Forth-83 nucleus, interrupt handler, multitasking kernel, and disk filing system. The initial CPU offering is an 8085 μP card, which includes an RS-232C serial port for terminal communication, two 8-bit parallel ports, five counter timers, and an 8-level priority interrupt controller.

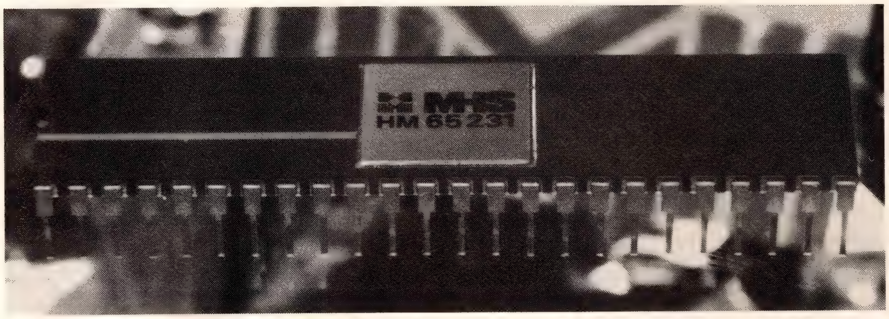


Development software includes a screen editor, macroassembler, debugging tool, floating-point package, ROM code generator, and EPROM programmer. The debug software lets you step through a program; it also provides you with a simultaneous display of the Forth programming code and the activity on the Forth stack. £1975.

British Telecom Microprocessor Systems, British Telecom Research Laboratories, Martlesham Heath, Ipswich IP5 7RE, UK. Phone (0473) 642933. TLX 98376.

Circle No 673

Dual-port static RAM features on-chip arbitration logic



The HM 65231 2k×8 CMOS dual-port static RAM has one port with separate address and data buses and a second port with a multiplexed address/data bus. This structure is designed to facilitate communication between multiplexed and nonmultiplexed μPs or system buses.

On-chip arbitration logic, which you can program to operate in one of three modes, sorts out contention between two buses when both attempt to access the RAM at the same time: The first mode allows communication between two processors that can have wait states, thus preventing simultaneous access by asserting a busy signal at the appropriate RAM port. The second mode allows you to connect a processor bus that can have wait-states to another bus that cannot. The third mode uses two of the RAM's memory locations as flag registers to implement as many as 16 concurrent, software-controlled communications channels between the two ports.

Interrupts, generated and cleared respectively as one register updates and the other reads the flag registers, allow you to indicate message availability. The HM 65231 is packaged in a 48-pin DIP or LCC, has a 2V data-retention voltage, and a standby current consumption of 100 μA. It sells for $19.30 (100).

Matra-Harris Semiconducteurs, La Chantrerie, Rte de Gachet, BP 942, 44075 Nantes Cedex, France. Phone (40) 303030. TLX 711930.

Circle No 668

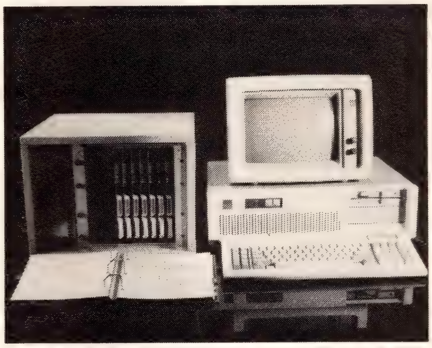
Harris Corp, Box 883, Melbourne, FL 32902. Phone (305) 724-7000.

Circle No 669

Transputer evaluation module allows you to assess real-time concurrency

The ITEM 400 Transputer evaluation module comprises a fully powered and enclosed card cage capable of accepting as many as 40 Transputers on 10 IMS-B003-1 plug-in cards, together with a Transputer card and development-system software for an IBM PC/XT or PC/AT.

The IBM PC card and development-system software allow you to create and debug programs and then download compiled code into the array of 40 Transputers in the card cage for performance evaluation of the concurrent processing in real time. (Compilers for Pascal, C, and Fortran are in preparation.) The evaluation package is also available with cards and boards for VAX and MicroVAX computers.



Each of the 10 plug-in evaluation boards in the card cage carries four IMST414 32-bit Transputers, each with 256k bytes of local RAM and each configured via the Transputers' communication links into a square array. The eight free Transputer links (two from each Transputer) are brought out to the board's edge connector so that you can configure multiple boards as 2- or 3-dimensional arrays. Each Transputer can operate at 7 MIPS, giving the total system a concurrent-processing capability of approximately 300 MIPS. For larger systems, you can link in additional ITEM 400 chassis. The chassis also accepts other cards from the company's range of evaluation boards. Fully populated with IMS-B003-1 boards, the ITEM 400 costs £40,000. An unpopulated chassis is available £1500.

Inmos Ltd, Whitefriars, Lewins Mead, Bristol BS1 2NP, UK. Phone (0272) 290861. TLX 444723.

Circle No 670

Inmos Corp, Box 16000, Colorado Springs, CO 80935. Phone (303) 630-4000.

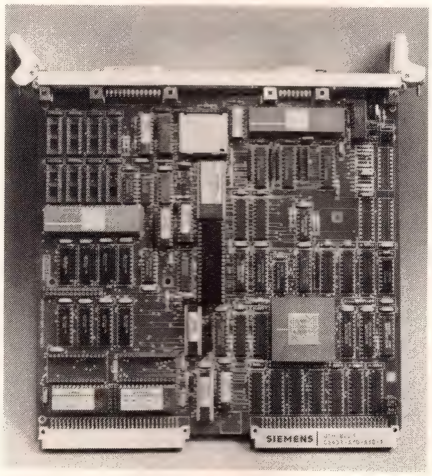
Circle No 671

Multibus II board family includes CPU, memory, and communications cards

The OSM-B family of Multibus II computer boards include CPU, memory, and serial interface cards, plus a central services module that links the company's 16-bit AMS Bus systems to the Multibus II.

Priced at DM 7320, the OSM-B26 CPU card runs an 8-MHz 80286 μP, plus a DMA controller and, optionally, a math coprocessor. It has two 28-pin JEDEC memory sockets and an LBX II Bus interface for local memory extension. Two serial interfaces and a 24-line parallel port, which you can configure as a SCSI, Centronics, or general-purpose I/O port, handle input and output. An SBX interface connector allows you to add piggyback I/O modules.

The OSM-B16, priced at DM 5500, is an 80186-based single-board computer with as much as 512k bytes of dual-ported dynamic RAM, four 28-pin static-RAM/EPROM sockets, and serial and parallel I/O ports similar to those of the OSM-B26 board. An 8087 math coprocessor and an 82258 advanced DMA controller are optional additions.



Memory support is provided by the 32-bit OSM-B11 series of dynamic RAM cards, ranging in capacity from 512k bytes to 4M bytes. The memory is dual ported to the Multibus II PSB and LBX II buses, and the boards feature an 8k-byte cache that gives no-wait-state access via the LBX II bus when the data requested is in the cache memory. A 1M-byte version costs DM 7325. There's also a DM 4200 universal memory board, the OSM-B130, with 16 28-pin, JEDEC-standard memory sockets.

Communications boards include the OSM-B223 Ethernet controller and the OSM-B222 serial communications controller board; each have an onboard 80186 μPs and cost DM 6000. The OSM-B223 Ethernet controller supports iNA-960 ISO network-communications software. The OSM-B222 communications board has six serial channels, expandable to ten. The OSM-B500 central services module, which integrates Multibus II central-system functions, costs DM 2700.

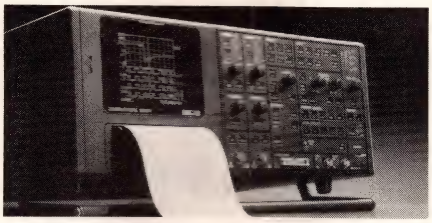
Siemens AG, Zentralstelle fur Information, Postfach 103, 8000 Munich 1, West Germany. Phone (089) 2340. TLX 5210025.

Circle No 672

Autoranging digital-storage scope incorporates graphics printer

The SE571 is a 2-channel digital-storage oscilloscope featuring an integral thermal printer that provides, in less than 10 sec, a hard copy of waveforms captured on screen. In addition, you can use it as an 8-channel, 25-MHz logic analyzer.

The storage scope samples each of its analog input channels to 8-bit resolution at 25 MHz and can reconstruct input waveforms with frequencies as high as 10 MHz by nonlinear interpolation. An "aliasing" indicator on the CRT warns you if the selected sampling rate is too low to faithfully reconstruct the signal.



When using it as a logic analysis, you can set up a binary trigger word and generate data either as a timing diagram or as an alphanumeric list. A combinational mode allows you to capture simultaneously one analog signal and four logic signals. The oscilloscope incorporates autozero circuitry to eliminate zero drift and automatic input-range selection. Twin cursors allow you to evaluate captured traces for voltage, time, and frequency measurements. Additional features include nonvolatile storage of as many as 10 instrument setups and waveforms, a real-time clock, and an optional IEEE-488 interface. $6500.

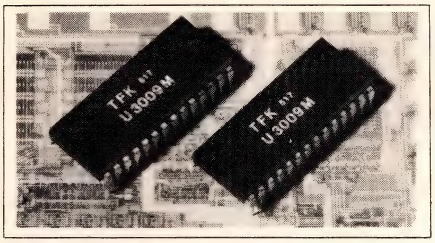
BBC-Goerz Electro GmbH, Sonnleithnergasse 5, Postfach 204, 1101 Vienna, Austria. Phone (0222) 6436660. TLX 133161.

Circle No 674

BBC-Metrawatt/Goerz, 2150 W 6th Ave, Broomfield, CO 80020. Phone (303) 469-5231.

Circle No 675

Products from Europe



A/D CONVERTER

The U3009M A/D-converter IC integrates a 4-channel input multiplexer, an S/H amplifier, and an 8-bit successive-approximation A/D converter in a 28-pin plastic DIP. Its typical clock-frequency capability is 100 kHz; each A/D conversion takes 16 clock cycles. An on-chip, integrated clock oscillator provides stand-alone, continuous sampling.

The device comes in three versions having absolute accuracy specifications of ±0.4%, ±0.8%, and ±1.6%. All devices spec differential nonlinearity of ±0.2% (approximately ±½ LSB) and integral linearity error not exceeding 0.3% (approximately ¾ LSB). The U3009M, which operates from a single 5V supply, can digitize analog inputs ranging from 0V to the positive supply-voltage level. You can interface the IC to a wide variety of μPs by using its 8-bit serial or parallel interfaces for control of input-channel selection and for data output. $4.50 (100) for a version with 1.6% accuracy.

Telefunken Electronic GmbH, Theresienstrasse 2, Box 1109, 7100 Heilbronn, West Germany. Phone (07131) 670. TLX 728746.

Circle No 452

AEG-Telefunken Corp, Box 3800, Somerville, NJ 08876. Phone (201) 722-9800.

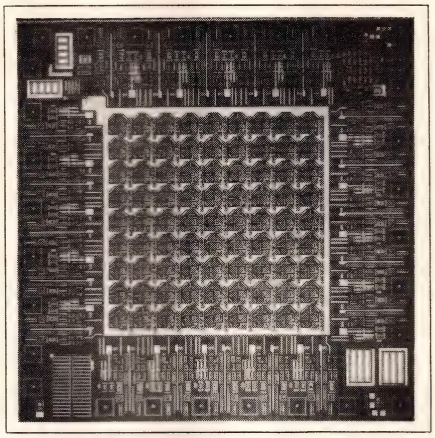
Circle No 453

DIP SWITCHES

CDB Series low-profile DIP switches are available with one to 10 single-throw poles on a 0.1-in. pitch. The switches extend 4.92 mm above the pc board and are available with a protruding screwdriver-slot or piano-key-style actuator. The switches feature silver contacts that are suitable for low-level applications. They have a nominal voltage rating of 24V (50V max), a maximum switching current of 200 mA, and a switched-power rating of 5 VA. Their contact resistance is 47 mΩ max, and the devices can withstand 2000 operations. Each switch section is sealed with an O-ring; the seal allows for solvent-aided cleaning after soldering. The screwdriver-slot-actuator version is suitable for use with automatic-insertion equipment. From Fr fr 3.47 to Fr fr 10.04 (500).

ITT Composants et Instruments, 157 rue des Blains, 92220 Bagneux, France. Phone (1) 46658555. TLX 260712.

Circle No 458



LINEAR/DIGITAL IC

The Digilin P Series of semicustom ICs has a matrix of logic cells that's surrounded by integrated components suitable for implementing linear functions. Targeting low-power applications, the arrays operate from 1 to 15V supplies and draw supply currents as low as 1 μA/gate. Each linear cell on the periphery of the chip includes two 30-mA, 15V transistors, two 12-mA, 15V transistors, four 3-mA transistors, and 13 resistors ranging in value from 600Ω to 500 kΩ. The transistors and resistors are arranged as matched pairs. The corners of the chip incorporate additional components, including 120-mA transistors, low-offset transistor pairs, a bandgap reference, a voltage regulator, 35-pF diffused capacitors, and numerous resistors. Available devices range from a 128-gate array with 16 linear cells to an 1152-gate array with 44 linear cells.

The ICs are available in two versions that spec gate-supply currents of 4 and 1 μA per gate and accept maximum clock rates of 1.6 MHz and 400 kHz, respectively. By connecting the gates' load resistors in parallel, you can increase the clock frequencies of the two versions to 4.8 and 1.2 MHz, respectively. From $1 to $8 (100,000), depending on size, complexity, and packaging requirements.

Ferranti Electronics Ltd, Fields New Rd, Chadderton, Oldham OL9 8NP, UK. Phone 061-624 0515. TLX 668038.

Circle No 454

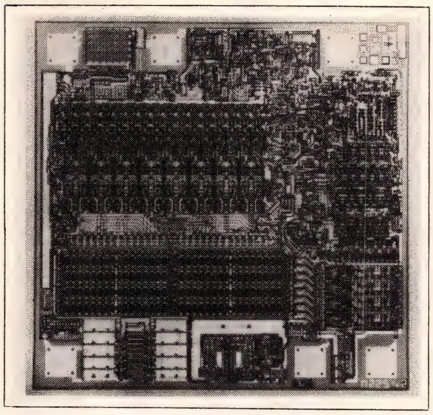
Ferranti Interdesign Inc, 1500 Green Hills Rd, Scotts Valley, CA 95066. Phone (408) 438-2900.

Circle No 455

SERIAL EEPROM

The 8-pin M9306 is a 16×16-bit EEPROM that provides serial access via a serial data clock and separate data-input and -output pins. You can access data at a maximum clock rate of 500 kHz. The EEPROM has a data-retention period of greater than 10 years, and it withstands more than 10,000 erase/write cycles per word. It has an on-chip programming-voltage generator, so it can operate from a single 5V supply. It draws 1.5-mA typ operating current.

You control read/write operations in the memory by using the data-input pin to send a 4-bit instruction, 4-bit address, and (for write operations) a 16-bit data word. Read data appears at the output pin. Seven instructions allow you to read, erase, or write to single 16-bit locations, to write the same data simultaneously to all 16 locations, to erase the entire memory, and to enable or disable the erase/write



mode. The EEPROM's chip-select pin doubles as an erase/write-pulse pin; it requires an erase/write pulse whose width is 5 msec min. $1 (50,000).

SGS-Microelettronica Spa, Via C Olivetti 2, 20041 Agrate Brianza, Italy. Phone (39) 65551. TLX 330131.

Circle No 448

SGS-Semiconductor Corp, 1000 E Bell Rd, Phoenix, AZ 85022. Phone (602) 867-6100.

Circle No 449

X.25 COMM IC

The SAB82520 high-level serial-communications controller features two independent, full-duplex HDLC (high-level data-link control) channels that transmit data at rates as high as 4M bps. The controller uses the X.25 LAPB/LAPD protocols (link-access protocols B and D). In auto mode, the controller performs the bit-oriented, layer-1 functions of the ISO HDLC communications protocol and performs some layer-2 functions. For instance, it evaluates the layer-2 control field to perform communications procedure handshaking. Functions such as connection setup and recovery from protocol errors require CPU support.

In transparent mode, the controller passes the data field and the layer-2 headers directly to the CPU, giving the CPU full control of the communication procedure. Separate transmit and receive FIFO buffers, each with a capacity of 64 bytes, operate as two interrupt-driven 32-byte swinging buffers, allowing the processor to read or write one buffer while the other is receiving or transmitting data. Fabricated in CMOS, the 28-pin device operates from a single 5V supply and draws 5-mA typ operating current when the clock rate is 4 MHz. Approximately DM 50 in OEM quantities.

Siemens AG, Zentralstelle für Information, Postfach 103, 8000 Munich 1, West Germany. Phone (089) 2340. TLX 5210025.

Circle No 456

Siemens Components Inc, 186 Wood Ave S, Iselin, NJ 08830. Phone (201) 321-3400.

Circle No 457

X.21 COMM IC

The HC5542 protocol controller is a μP for communications peripherals. It performs the low-level tasks associated with call setup and data transfer on communications channels using the CCITT X.21 protocol. The device works equally well in data-terminal equipment or in data-circuit-terminating equipment. You can select the IC's μP interface to be 8 or 16 bits wide, and you can operate the device under interrupt or DMA control. Alternatively, you can serially couple the IC to a synchronous communications controller, such as an HDLC (high-level data-link control) device.

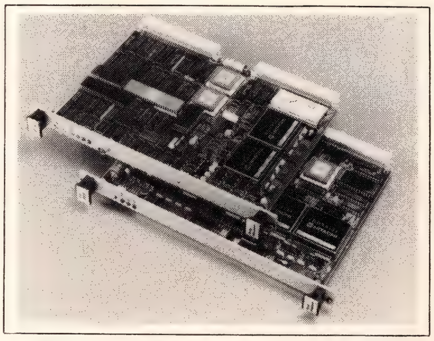
The controller works at serial data rates as high as 2M bps. You can select an internal or external transmit sync clock. The HC5542, which is fabricated in CMOS, operates from a single 5V supply, and draws 10 mA typ when operating with a 2-MHz clock input. $26.20 (100).

Matra-Harris Semiconducteurs, La Chantrerie, Rte de Gachet, BP 942, 44075 Nantes Cedex, France. Phone (40) 303030. TLX 711930.

Circle No 450

Harris Semiconductor, Box 883, Melbourne, FL 32902. Phone (305) 724-7000.

Circle No 451



BUBBLE MEMORY

Suitable for operation in harsh environments, the PME-BB1 VME Bus bubble memory provides as much as 17M bytes of nonvolatile storage and offers an average access time of 11 msec (16 msec max) per 256-byte page. Comprising a 1M-byte master card coupled to as many as eight 2M-byte slave cards via P2 connectors, the system uses standard SCSI-type command blocks to access the data. Data is buffered into dual-port RAM on the master card, and the onboard DMA controller transfers the data over the VME Bus. You can perform 8- or 16-bit data transfers to achieve a bus data rate as high as 2.6M bytes/sec for read operations or 3.6M bytes/sec for write operations. A front-panel RS-232C port provides for memory testing and servicing requirements. The master card costs £2800, and each slave card costs £3300.

Plessey Microsystems Ltd, Water Lane, Towcester, Northants NN12 7JN, UK. Phone (0327) 50312. TLX 31628.

Circle No 461

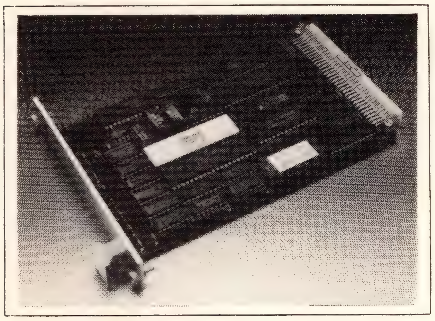
Plessey Microsystems, 1 Blue Hill Plaza, Pearl River, NY 10965. Phone (914) 735-4661.

Circle No 462

MASS STORAGE

The VMSC single-Eurocard mass-storage interface card for VME Bus systems provides you with hardware-independent control of such mass-storage devices as Winchester-disk, floppy-disk, and streaming-tape drives. An onboard Z80 μP and associated control firmware au-

Products from Europe



tomatically identify the media format and perform blocking/deblocking of 128-byte records in response to 31 high-level board commands, such as verify, log-in, format, and scan commands.

A 16k-byte RAM (or an optional 48k-byte RAM) operates as two data buffers. The buffers are updated according to a last recently used algorithm, which minimizes data-read/write times. Data passes directly to the board's VME Bus interface via a 128-byte FIFO channel, speeding bus data transfers. The board has DMA and interrupt capabilities. In addition, the onboard μP automatically verifies write data and eliminates head-seek faults. It also performs power-up diagnostics and run-time detection of media errors. The controller typically draws 800 mA from the VME Bus's 5V supply. DM 1750.

Pep Elektronik Systeme GmbH, Am Klosterwald 4, 8950 Kaufbeuren, West Germany. Phone (08341) 8974. TLX 541233.

Circle No 463

Pep Modular Computers Inc, 600 N Bell Ave, Pittsburgh, PA 15106. Phone (412) 279-6661.

Circle No 464

CRYSTAL OSCILLATORS

Crystal oscillators in the QCO-2000 family include TTL-compatible transistor oscillators, TTL-compatible gated oscillators, and CMOS-compatible parts. All types have a standard stability rating of ±100 ppm, which includes variations over temperature range, supply voltage, and time. Stabilities of ±500 and ±50 ppm are available as options. Transistor oscillators are available in standard frequency values between 250 kHz and 70 MHz. Gated oscillators come in 4- to 60-MHz versions, and CMOS versions come in 62.5-kHz to 20-MHz models.

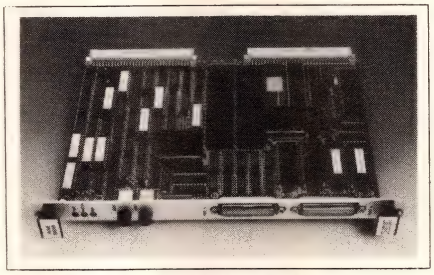
The transistor- and gated-oscillator versions both operate from 5V supplies and start up within 20 msec max. They draw 40 and 25 mA max, respectively. The CMOS-compatible oscillators operate from 3 to 6V supplies, start up in 1.5 msec max and draw 4 mA max. All devices operate over 0 to 70°C and are housed in hermetically sealed, low-profile metal packages. From £2.13 to £3.38 (1000).

STC Components Ltd, Quartz Crystal Unit, Edinburgh Way, Harlow, Essex CM20 2DE, UK. Phone (0279) 26811. TLX 818746.

Circle No 459

Stantel Components, Schaumberg, IL 60195. Phone (312) 490-7150.

Circle No 460



BOARD COMPUTER

The HVME-SB286 is a VME Bus-compatible single-board computer that uses an 8-MHz 80286 μP and an optional 80287 math coprocessor. The μP runs without wait states from 1M byte of dual-ported onboard RAM. Four 28-pin JEDEC sockets allow you to install as much as 256k bytes of EPROM firmware. Serial I/O takes place via two RS-232C ports that can handle asynchronous communication at rates as high as 38.4k baud. You can reconfigure one port for RS-422 operation, and you can operate it to 1M baud in synchronous mode. The board comes with a 24-line parallel-I/O port and three independent programmable timers. Its A24/D16 VME Bus interface conforms to VME Bus Revision C and includes an onboard bus arbiter, a 7-level interrupt handler, and SYSCLK and SYSRESET functions. Firmware supplied with the computer includes a line assembler/disassembler and debug firmware. £2990.

High Technology Electronics Ltd, 303-305 Portswood Rd, Southampton SO2 1LD, UK. Phone (0703) 581555. TLX 477465.

Circle No 466

LOGIC ANALYZER

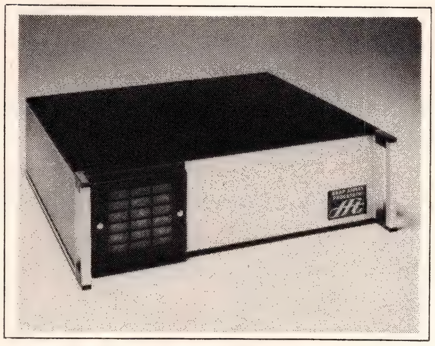
The basic version of the TA3000 modular logic analyzer offers 32-channel state analysis at clock speeds as high as 25 MHz. It provides 8-channel timing analysis, with glitch-capture capability, at 100 MHz. Plug-in cards allow you to expand the analyzer's capabilities to 96 states and 16 timing channels without loss of speed. The timing analyzer's source memory is 3500 words deep, and the state analyzer's memory is 1024 words deep. Reference memories of equivalent size are provided for data comparisons.

The analyzer's multilevel triggering includes conditional trigger/trace sequencing with clock, event, and loop-count capabilities. You can set up state/timing cross-triggering and correlation. The analyzer operates from a Z80A-based CP/M+ computer with two 5¼-in. floppy-disk drives. It provides IEEE-488, Centronics, and RS-232C interfaces. A full ASCII keyboard with special function keys provides menu-driven, soft-key operation. The manufacturer plans to offer additional expansion capabilities, including word generators and high-speed timing modules, for the analyzer. From £5295 to £7995.

Thandar Electronics Ltd, London Rd, St Ives, Huntingdon, Cambs PE17 4JH, UK. Phone (0480) 64646. TLX 32250.

Circle No 480

Products from Europe



ARRAY PROCESSOR

Executing arithmetic operations at more than 6M flops, the Snap synchronous numeric array processor enhances the performance of computer systems for math-intensive applications. The manufacturer provides a Fortran-77 compiler that lets you recompile standard Fortran programs so they'll run on the array processor.

The Snap is a self-contained unit that incorporates as much as 64M bytes of dual-port memory, which communicates data and coefficient information from the host computer. Host-adapter cards are available for the DEC Q22 Bus (making the Snap compatible with both PDP Series and MicroVAX systems) and for the IBM PC/AT. The Snap's arithmetic processor accommodates DEC and IEEE-P754 32-bit floating-point formats, and it can convert data between the two formats. The processor also accommodates integer operations. It performs floating-point addition, subtraction, and multiplication within a 167-nsec instruction cycle. It performs floating-point division, which converges to 32-bit precision in seven instruction cycles. In addition to the Fortran-77 compiler, software support includes a standard library of Fortran-callable subroutines, an assembler, an interactive debugger, and a Snap simulator for program development. From approximately £12,000, including software.

Fast Firmware Techniques Ltd, 151 University Rd, Southampton, Hampshire SO2 1TS, UK. Phone (0703) 585550.

Circle No 473

DEBUG SOFTWARE

Using the SEM68000 test/monitor software, you can debug target systems incorporating 68000, 68010, or 68020 μPs either from within a Unix system environment or via a simple terminal link. The software allows you to download programs developed on the Unix system to the target system. You can also download symbol tables, which are recognized by the SEM68000's monitor and debugger commands and by its integral assembler/disassembler. The monitor has over 40 commands, including run, trace, and breakpoint functions, and its control shell supports macro definitions that allow you, for example, to add new commands or to execute existing commands either conditionally or in combination with others.

A configurable I/O module within the software allows communication between the Unix system and the target system via a serial link or a backplane bus. You can also add driver routines to operate the SEM68000 from a terminal via a serial link. The software is available as source code for Unix V or as object code that you can install in ROM. In object-code form, the SEM68000 requires 24k bytes of ROM and 8k bytes of RAM. From DM 5000 (in object-code form) to DM 28,000 (as fully documented source code).

Stollmann GmbH, Max-Brauer-Allee 81, 2000 Hamburg 50, West Germany. Phone (040) 3890030. Teletex (17) 403226.

Circle No 467

DEVELOPMENT SYSTEM

Operating in conjunction with an IBM PC or a compatible computer, the AT51 development system provides software development, in-circuit emulation, and EPROM-programming facilities for 8051 Series microcontrollers. Software development tools include a full-screen windowing text editor, an assembler capable of assembling more than 2000 lpm on an IBM PC/AT, a linking/loader, and file-conversion utilities that can generate and accept a variety of code formats for file exchange. The symbolic in-circuit emulator allows you to trace address, data, I/O-port-activity, and control lines, as well as eight external lines, in the emulator's 2048-word trace memory. Traces can be triggered by a combination of two multiple-event recognizers, each comprising address and data segments. A hardware timer facility allows you to monitor elapsed program-execution time or to halt emulation after a specified period. The system's built-in PROM programmer programs NMOS and CMOS EPROMs, as well as the 8751 microcontroller's on-chip EPROM. $7250.

Ashling Microsystems Ltd, Enterprise House, Plassey Technological Park, Limerick, Ireland. Phone 061-338177. TLX 70182.

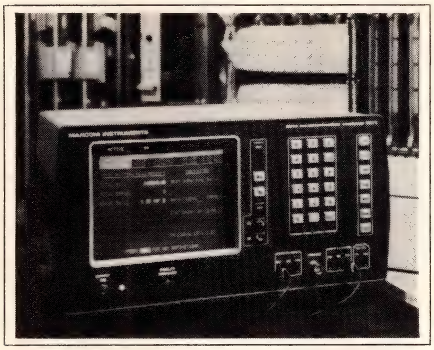
Circle No 470

Ashling Microsystems Inc, 542 Lakeside Dr, Suite 2, Sunnyvale, CA 94086. Phone (408) 720-9131.

Circle No 471

COMM ANALYZER

The 2871 data-communications analyzer performs in-service or out-of-service testing on data networks operating at frequencies between 50 bps and 150k bps. For in-service



testing, the analyzer monitors the framing bits of structured data traffic to estimate the bit-error ratio. For out-of-service checks, the analyzer's pattern generator and error detector operate on a looped-back line to detect errors over a period as long as 30 hours. You can display a histogram of data-error timing on the instrument's integral CRT or print out details of each error (together with the error's time of occurrence). The analyzer supports RS-232C, RS-449, V.35, and X.21 data-line interfaces and binary, codirectional, and contradirectional data encoding. £5500.

Marconi Instruments Ltd, Longacres, St Albans, Hertfordshire AL4 0JN, UK. Phone (0727) 59292. TLX 23350.

Circle No 474

Marconi Instruments, 3 Pearl Ct, Allendale, NJ 07401. Phone (201) 934-9050.

Circle No 475

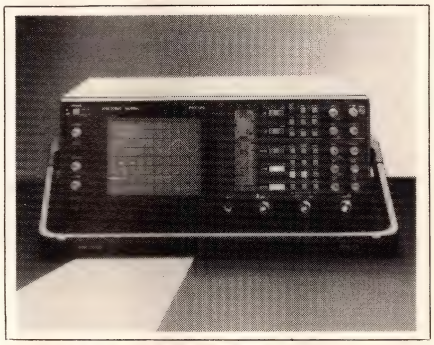
ADD-ON PROGRAMMER

Linked to an IBM PC or compatible computer via an RS-232C serial port, the Box Series device programmers provide you with memory- and PLD-programming capabilities. The series comprises three programmers: the Mem-Box, which programs PROMs, EPROMs, EEPROMs, and single-chip microcomputers; the Logi-Box, which handles a variety of PLD devices; and the Uni-Box, which combines the capabilities of the Mem-Box and Logi-Box in one unit.

You can download programming data into as much as 448k bytes of RAM in the programmer. Data-translation and communication software provided with the programmers includes a file manager, a screen editor, and an assembler/disassembler for logic equations, as well as variable-format file-transfer utilities and remote-control and terminal-emulation utilities. Five soft keys access all the system functions relevant to a particular operation. The display shows system and device menus, device details and pinouts, number bases, error lists, starting and ending addresses, checksums, logic equations, and IFL fuse-link tables. You can save data, source, and object files to disk and load extension files from disk. Mem-Box, Fr fr 29,300; Logi-Box, Fr fr 31,000; Uni-Box, Fr fr 52,000.

Micropross, Parc d'Activité des Prés, 5 rue Denis-Papin, 59650 Villeneuve d'Ascq, France. Phone (20) 479040. TLX 120611.

Circle No 472



OSCILLOSCOPE

Abandoning the traditional approach to front-panel layout, the PM3050 family of 50-MHz oscilloscopes features up/down range controls and soft-key function selection, combined with a backlit LCD. An autoset function automatically selects appropriate amplitude, timebase and trigger-mode settings for instant trace setup. The scopes also include trigger-view/third-trace facilities, and free-run triggering is automatically selected when you ground the trigger source to prevent loss of the trace.

Both the single-timebase PM3050 and the delayed-timebase PM3055 scopes have a 3-dB bandwidth from dc to 50 MHz. At 50 MHz, vertical sensitivities are 20 mV/div to 10V/div. From dc to 35 MHz, the scope adds 2-mV/div to 10-mV/div sensitivities. The scope automatically compensates for probe attenuation by detecting the type of probe connected to the input. The main timebase ranges from 0.5 sec/div to 50 nsec/div, and the delayed timebase ranges from 1 msec/div to 50 nsec/div. The oscilloscopes operate from ac-line inputs between 90 and 260V or from an optional battery-pack unit. An optional external IEEE-488 interface module accommodates remote control for ATE applications or for automatic performance verification and scope calibration. Around $1300 for the PM3055.

Philips, Industrial and Electro-acoustic Systems Div, Box 523, 5600 AM Eindhoven, The Netherlands. Phone (040) 757005. TLX 51573.

Circle No 478

Philips Test & Measuring Inc, 85 McKee Dr, Mahwah, NJ 07430. Phone (201) 529-3800.

Circle No 479

GRAPHICS SYSTEM

The PIG1/68K graphics-interface board and ULUT1/68K color-look-up board combine to provide a graphics subsystem for VME Bus systems. The PIG1/68K's CRT controller accommodates a variety of graphics primitives and area-fill and windowing functions, and it allows for video zooming and horizontal panning on a pixel-by-pixel basis. The board's dual-port video RAM allows you to update the video image without causing noise to appear in the display. You can configure the RAM in three bit-plane arrangements. The single-bit-plane mode provides one bit plane of 4k×2k pixels with a programmable display window. The other modes provide either two bit planes of 2k×2k pixels or four bit planes of 1k×2k pixels. The multiple-bit-plane modes allow you to implement color displays or to control the display blinking of individual pixels. The board operates with dot-rate clock frequencies as high as 64 MHz, and it provides 1024×786-pixel display resolution at a 60-Hz frame rate.

The ULUT1/68K color-look-up board lets you use as many as eight bits of pixel information to display as many as 256 colors from a palette of 256k colors. The board includes a pixel mask register and special functions for animation and overlay applications. The board accommodates pixel rates as high as 55 MHz and delivers an RS-170-compatible video output. PIG1/68K, DM 6600; ULUT1/68K, DM 2600.

Eltec Elektronik GmbH, Galileo-Galilei-Strasse 11, 6500 Mainz 42, West Germany. Phone (06131) 50630. TLX 4187273.

Circle No 465

PC-BOARD CAD

The Ranger pc-board CAD software package provides interactive or fully automatic component placement and routing of pc-board designs on an IBM PC/AT, an Olivetti M24-SP, or compatible computers. The system handles board sizes as high as 32.76 in.², and it has a working resolution of 0.001 in. You can design with as many as 16 track layers and 16 different track widths. The software's post-routing design-rule checks include automatic checking of track width, pad size, clearance, and connectivity. Using a mouse, you can enter circuit data either as a schematic diagram or as a net list. CAD software produces circuit schematics, assembly drawings, parts lists, and numerical-control drill tapes. From £8000 to £12,000.

Seetrax Ltd, 14a Tournerbury Lane, Hayling Island, Hants PO11 9DJ, UK. Phone (0705) 465752. TLX 86572.

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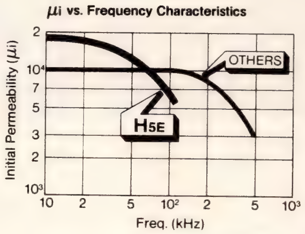

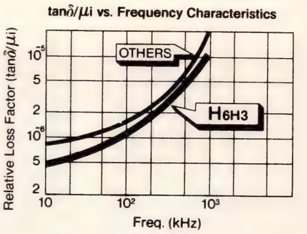

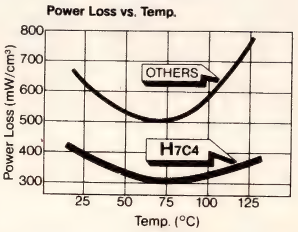

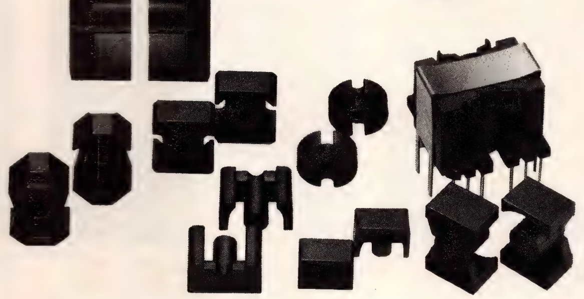

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CIRCLE NO 123

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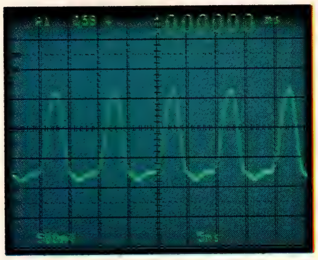
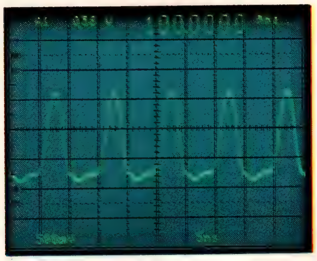
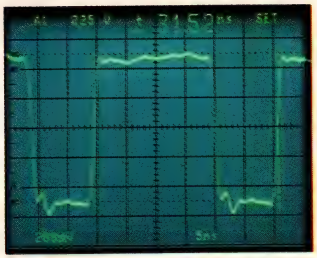


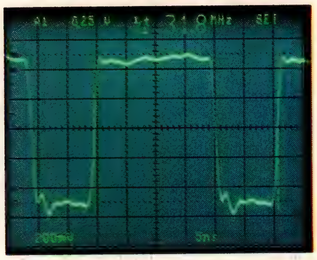
A period measurement is made on a 100 MHz clock using the extended accuracy and resolution of the Counter/Timer/Trigger in the 2465 DVS.



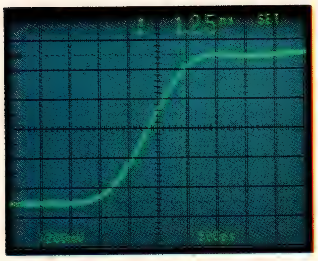
A frequency measurement is made with the same high precision. Simply press two buttons, and the period measurement on the left is converted to frequency.

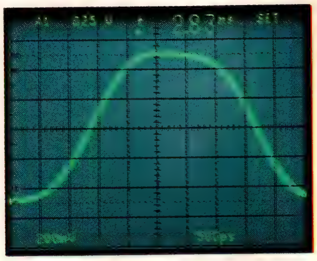


Short time intervals can be measured most accurately with the easy-to-use time cursors. They also make quick work of longer intervals, with 1% accuracy.

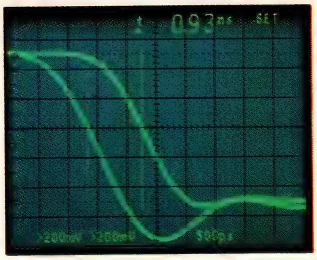


Calculated frequency takes only seconds. The time cursor measurement on the left can be converted to frequency with push-button ease and 1% accuracy.

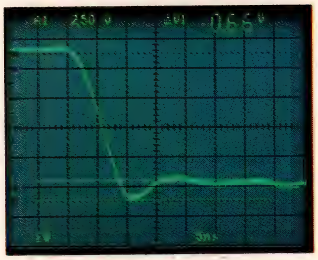




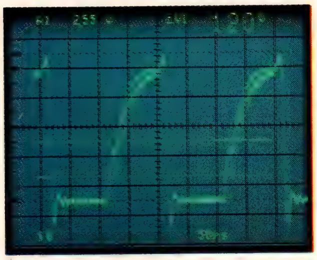
This fast-pulse rise time is nearly that of the scope. The 2465 achieves maximum bandwidth with minimum waveform aberrations. This level of pulse response ensures that **pulse width** and amplitude measurements on fast waveforms (above) truly reflect conditions in a circuit under test.



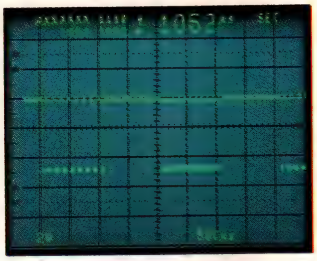
Propagation delay measurement accuracy is assured by built-in propagation delay matching. Delay between Channels 1 and 2 can be corrected to the probe tip.



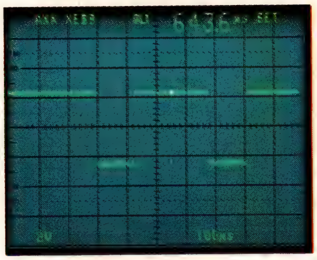
Overshoot and ringing measurement accuracy requires flat response in a probe/oscilloscope system. Tek probes and scopes are designed to work together.



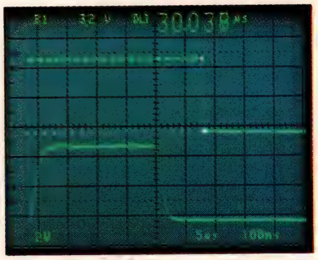
Logic-level violations can be spotted quickly on a TTL waveform (above) with measurement cursors set to define logic-level boundaries.



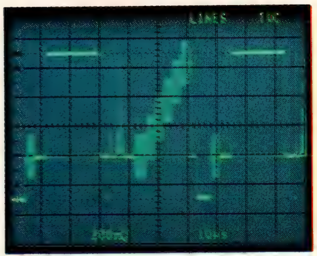
The Word Recognizer (with a binary word) is used to pick out a pulse train in a data stream. The time cursors measure pulse train duration.



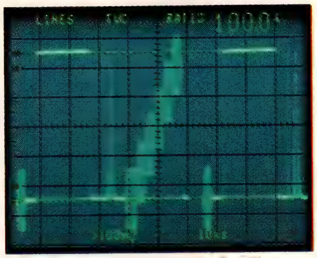
Identify a word position. The Word Recognizer (in HEX) is intensifying a word position and measuring delay relative to a waveform on another line.



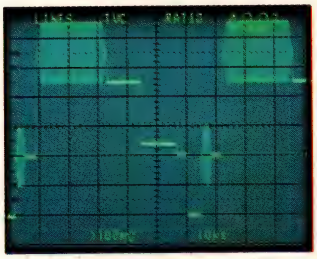
Delayed sweep is used to expand the last pulse in a pulse train. The intensified zone identifies the expanded pulse position.



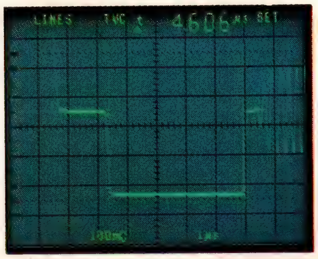
TV line trigger in the 2465 DVS displays a full-field composite test signal. The built-in TV clamp circuit removes hum and tilt on the ac-coupled video.



Calibrate cursors in IRE units with variable attenuation. Blanking level to reference white level is defined as 100 IRE units in NTSC video.



Burst amplitude should be 40 IRE units in NTSC video. The cursors quickly measure other waveform amplitudes. Field triggering checks any line.



Sync width and blanking are common, easy-to-make timing measurements. Accurate time measurements can be made anywhere in a video system.

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Features	**2445**	**2465**	**2465 CTS**	**2465 DMS**	**2465 DVS**
Bandwidth	150 MHz	300 MHz	300 MHz	300 MHz	300 MHz
Max. Sweep Speed	1 ns/div	500ps/div	500ps/div	500ps/div	500ps/div
Accuracy; Vert/Hor	2%/1%	2%/1%	2%/1%	2%/1%	2%/1%
Vertical Sensitivity	2 mV/div	2 mV/div	2 mV/div	2 mV/div	2 mV/div
Trigger Freq. Range	250 MHz	500 MHz	500 MHz	500 MHz	500 MHz
Trigger Modes	Auto Level, Auto, Norm, Single Sequence				
Counter/Timer/ Trigger/Word Recognizer	*	*	STD	STD	STD
DMM	*	*	N/A	STD	STD
Video/TV	*	*	N/A	N/A	STD
Four P6131 Probes	*	*	STD	STD	STD
GPIB	*	*	STD	STD	STD
Rackmount	*	*	*	*	*
Warranty	3-year on parts and labor, including CRT				
Price†	$3590	$5350	$7150	$8400	$9200

Software	
TEK GURU for IBM PC/XT/AT and 2445/65/GPIB	$595
EZ-TEK 2400 for TEK 4041 and 2445/65/GPIB	$400

*Configurable only at time of order. Additional cost required.

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DESIGN CONSIDERATION	THE NEW CHIPSWITCH WAY	THE OLD DISCRETE WAY
Output	Dual SCR AC Output	Triac AC Output
Static dv/dt	600 Volts μ sec.	200 Volts μ sec. (Typ.)
RC Snubber	Not required.	Required.
Off-State Leakage	10μA over oper. temp. range. Can run neon.	15μA. Cannot run neon w/out added hardware.
Control Current	5mA max.	15mA Max.
Repetitive Turn-On	1.5 Volts	40 Volts
Load Voltage Range	24 to 280 VAC	(Designer Choice)
Surge Capability	30 Amps for 1 cycle.	(Designer Choice)
Isolation	3750 Volts RMS	(Design Task)

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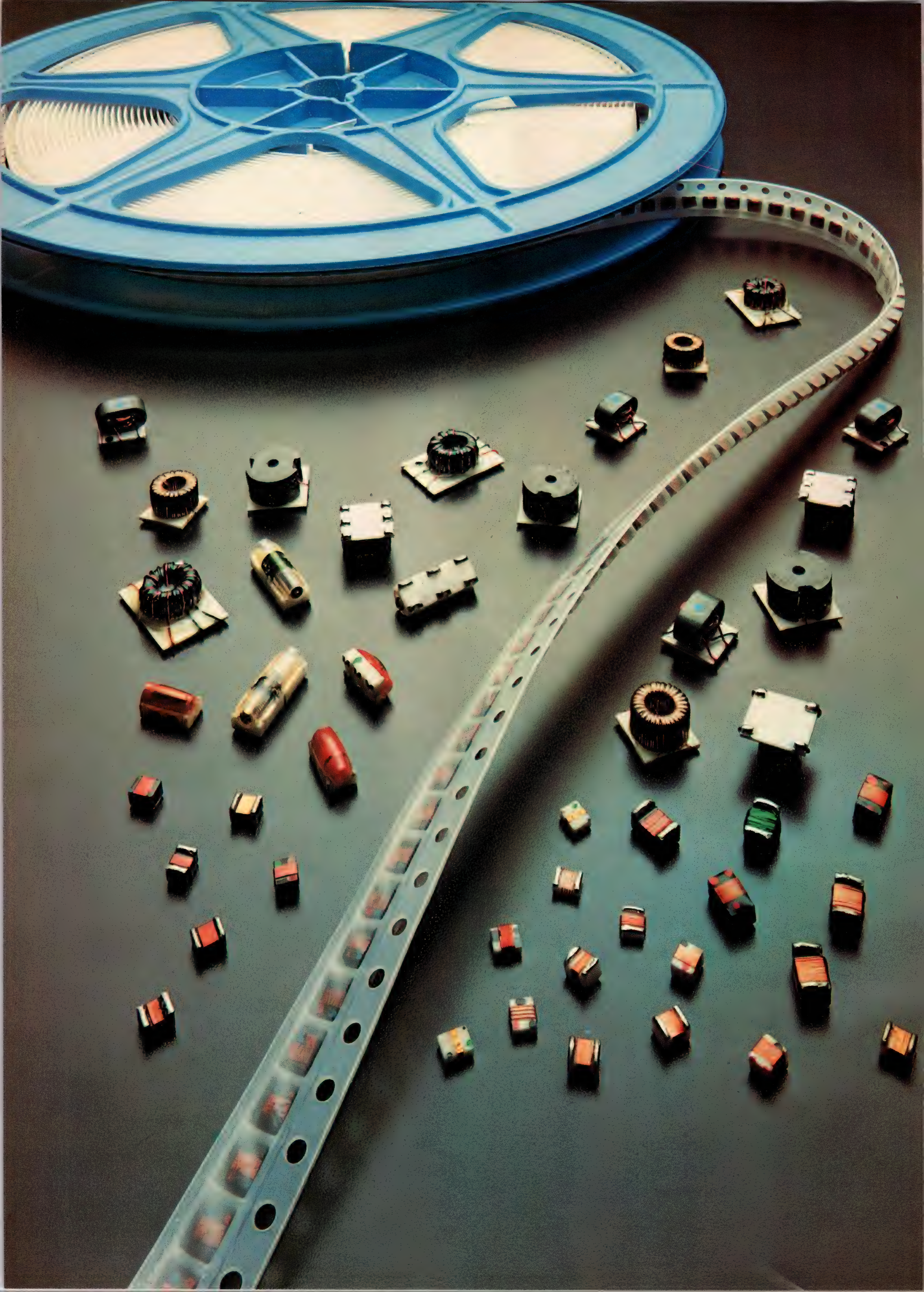


Lack of standards breeds diversity in SMD inductors

Steven H Leibson, *Regional Editor*

Of all the types of surface-mount devices (SMDs), inductors have received perhaps the least attention in SMD package standardization efforts. The result has been diverse inductor sizes and shapes, and SMD-inductor manufacturers are offering a wide range of products for many different applications. Standards for SMD inductors are currently under consideration, but in contrast with the operational characteristics of resistors and capacitors, those of inductors are greatly influenced by component size and shape, causing some manufacturers to view universal package standardization as a utopian goal.

Tables 1 and **2** are lists of representative SMD-inductor manufacturers and component series. Columns listing the component dimensions illustrate the range of sizes and shapes available and the lack of package standardization for SMD inductors. Leaded inductors have been manufactured for years without an EIA standard, but the automated assembly procedures associated with SMDs require precise component dimensions, so the lack of standard sizes for surface-mount inductors poses a problem.

Standards for surface-mount inductors have been slow to appear, so you must take care when selecting parts from more than one vendor. The wide variety of components available can meet your application and cost requirements if you know which specifications are critical to that application.

Steve Hinch, surface-mount-technology program manager for Hewlett-Packard's corporate manufacturing engineering department and chairman of the Surface Mount Technology Association's (Los Gatos, CA, (408) 354-9275) component standards subcommittee, proposes two standard sizes for wirewound SMD inductors: size codes A and B (**Table 3**). Devices conforming to these size codes can be either molded or conformally coated.

Wirewound surface-mount coils and transformers
(Coilcraft)

TABLE 1—REPRESENTATIVE SURFACE-MOUNT, FIXED INDUCTORS

		INDUCTANCE (µH)			DIMENSIONS (mm)			
MANUFACTURER	MODEL	MIN	MAX	Q (MIN)	LENGTH	WIDTH	HEIGHT	SHIELDED
COILCRAFT	1008FS	1.2	10	28	2.8	2.5	2.3	NO
	1008CS	0.1	1	25 TO 33	2.8	2.4	2.2	NO
	1008CT	0.004	0.1	30 TO 60	2.8	2.4	1.4	NO
	1611FS	12	1000	12 TO 34	4.3	3.6	3.0	NO
DALE	IMC-2014	0.1	1000	30 TO 50	5.1	3.4	3.9	NO
DELEVAN	0820	0.1	1000	15 TO 35	6.4	2.9	2.9	NO
	1330	0.1	10	25 TO 55	8.1	3.7	3.7	NO
	1331	0.1	560	36 TO 57	8.1	3.7	3.7	YES
PICONICS	PA	0.01	1000	15 TO 36	2.9	2.9	2.5	NO
	PG	0.01	1000	30 TO 45	4.1	3.2	3.2	NO
	PK	0.01	1000	30 TO 45	4.1	3.2	3.2	NO
	PW	0.01	1000	30 TO 45	4.6	3.6	2.4/1.7	NO
SFE	SMI-A	10	1000	20 TO 50	6.4	5.1	3.8	NO
	SMI-B	3.3	330	20 TO 50	4.2	3.4	2.5	NO
	SMI-400	1	100	NA	10.2	10.2	6.4	NO
	UCMR	0.01	27	25 TO 60	2.7	2.7	1.7	NO
	UCSR	0.01	1000	28 TO 50	3.9	3.2	2.0	NO
	WCMR	0.12	27	22 TO 30	2.5	2.5	1.7	NO
	WCSR	0.01	1000	28 TO 50	3.8	3.2	2.0	NO
SIEMENS	SIMID 01	0.068	8.2	35 TO 45	3.2	2.5	1.6	NO
	SIMID 02	0.1	100	NA	3.5	2.0	2.5	NO
STANDEX	MC1	0.068	6.8	30 TO 55 TYP	2.5	2.4	1.5	NO
	MC2	0.068	6.8	36 TO 65 TYP	2.5	2.4	2.0	NO
	MC3	0.18	0.47	55 TO 80 TYP	2.8	2.4	2.0	NO
	MC4	2.2	220	71 TO 81 TYP	2.7	2.5	2.4	NO
THINCO	L-30C	0.0016	0.094	20 TO 30	1.2	1.2	0.35	NO
	L-55C	0.0033	0.240	20 TO 38	1.7	1.7	0.35	NO
	L-100C	0.012	0.540	20 TO 50	3.0	3.0	0.35	NO
TOKO	32CS	0.1	220	NA	3.2	2.5	2.2	NO
	43CS	1	470	50	4.5	3.2	3.2	NO
	43FS	1	470	50	4.5	3.2	3.2	NO
	5CT	50	7500	50	5.5	5.5	5.3	NO
VANGUARD	26,000	0.01	10	42 TO 60	2.7	2.8	2.2	NO
	27,000	12	1000	12 TO 56	2.7	2.8	2.5	NO
	30,000	0.01	100	30 TO 60	2.7	2.8	1.7	NO
	33,000	0.01	1000	30 TO 75	3.4	4.1	3.3	NO
	34,000	0.1	10000	75 TO 100	3.4	4.1	3.3	YES

NA = INFORMATION NOT AVAILABLE

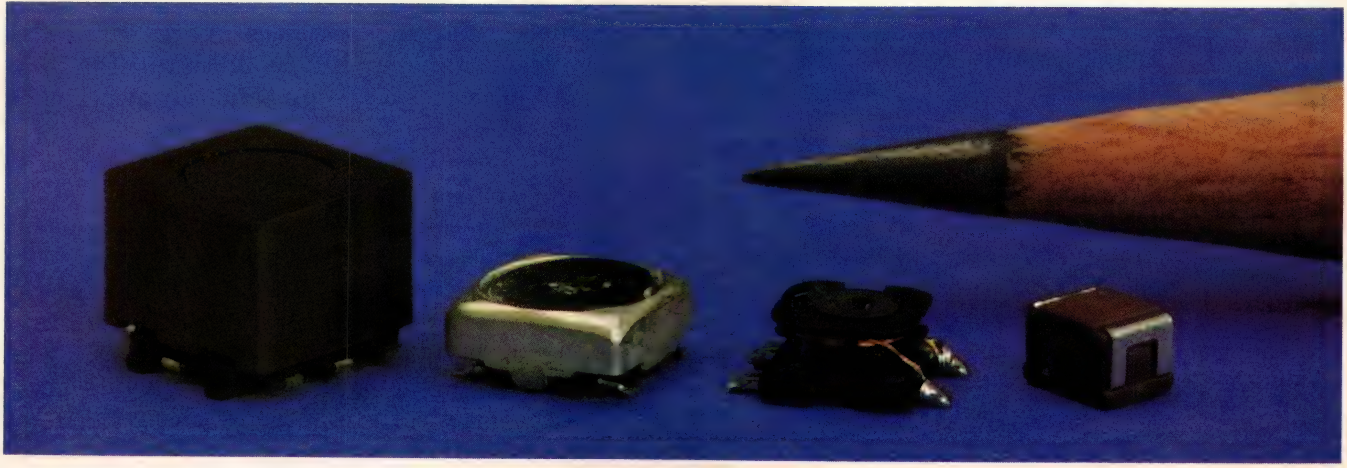
TABLE 2—REPRESENTATIVE SURFACE-MOUNT, TUNABLE INDUCTORS

		INDUCTANCE RANGE (µH)					DIMENSIONS			
		SERIES SMALLEST		SERIES LARGEST						
MANUFACTURER	MODEL	MIN	MAX	MIN	MAX	Q (MIN)	LENGTH	WIDTH	HEIGHT	TUNING ACCESS
COILCRAFT	2312MO	0.1	0.17	1.2	1.5	8 TO 40 TYP	6.7	3.6	3.4	SIDE
	3714MI	0.1	0.23	2.8	10	10 TO 30 TYP	10.54	4.5	4.1	SIDE
PICONICS	PGV	0.010	0.016	500	1000	20 TO 50	4.1	3.2	8.4	TOP
	PSV	0.010	0.016	75	150	20 TO 50	7.9	4.1	3.2	SIDE
	PVW	0.010	0.016	500	1000	20 TO 50	4.6	3.6	2.4	SIDE
TOKO	5CB	0.02 NOMINAL		1 NOMINAL		50 TO 70 TYP	5.0	5.0	4.2	TOP
	5CD	1 NOMINAL		500 NOMINAL		70 TYP	5.5	5.3	4.8	TOP
VANGUARD	29,000	0.016	0.019	110	140	19 TO 55	3.0	2.9	2.9	SIDE
	31,000	0.015	0.021	90	150	22 TO 50	3.3	4.2	5.7	TOP

TABLE 3—PROPOSED STANDARD SIZES FOR WIREWOUND SMD INDUCTORS

SIZE CODE	LENGTH (mm)	WIDTH (mm)	HEIGHT (mm)
A	3.2 ± 0.2	2.4 ± 0.4	2.2 ± 0.3
B	4.5 ± 0.3	3.2 ± 0.2	3.2 ± 0.3

Inductors have received perhaps the least attention in SMD package standardization efforts.



***Molded coil and top-tunable SMD inductors** (Toko America Inc)*

These two sizes are based on SMD-inductor package styles popular with consumer-electronics manufacturers in Japan. Hinch predicts that these packages will predominate, but he also says that a larger package standard is required for inductors of higher value. The A package is limited to inductances of 100 μH; the B package constrains inductances to approximately 1000 μH.

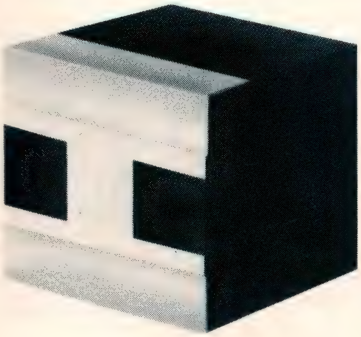
Coilcraft's Paul Liebman also believes that there will ultimately be standard package sizes for SMD inductors. He notes, however, that the body geometry of an inductor greatly affects the device's performance, and that a manufacturer cannot build components that cover the range of all desired characteristics in the proposed A and B packages. The product descriptions that follow underscore this relation between geometry and performance.

Package size and shape are not the only characteristics of SMD inductors that lack standards. Recommended tests for electrical parameters, test equipment, and test fixtures vary. For example, Vanguard recommends that electrical tests be performed on a Hewlett-Packard 4342A or Boonton 260A Q Meter for test frequencies of 250 kHz to 25 MHz, a Hewlett-Packard 250B RX meter for test frequencies from 25 to 150 MHz, and a Hewlett-Packard 4191A impedance analyzer for frequencies of 25 MHz to 1 GHz. Vanguard sells different test fixtures for these three frequency bands as well.

John O Renskers, in Coilcraft's application note AN-C101, points out that no test instrument can provide you with an absolute reading and that you will have problems correlating readings between test instruments unless you have designated one device as your standard. He states that both you and your vendor must use the same test fixture in most cases if you wish to obtain similar results. In addition, for inductors that carry high dc, you should use a test instrument that allows you to inject dc into the device under test during the inductance measurement, because the apparent inductance of a coil decreases with increasing dc.

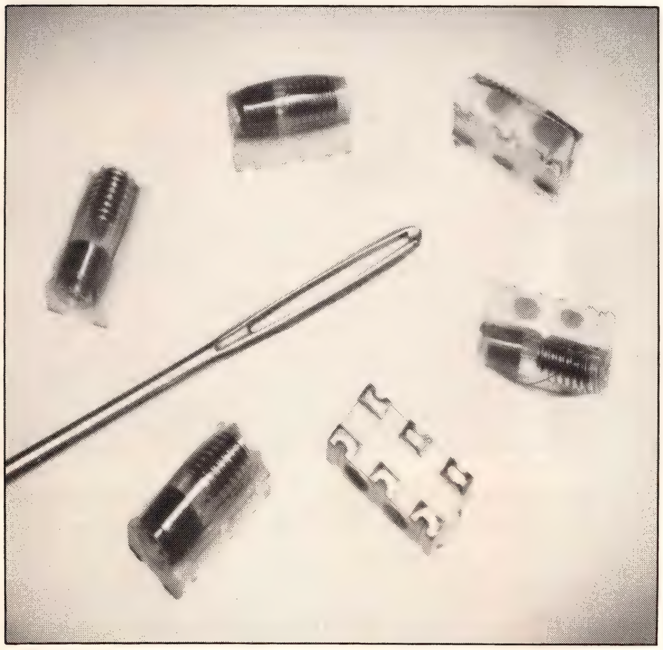
A fixed-inductance SMD inductor comes in either wirewound or monolithic multilayer form. Wirewound inductors predominate in vendor catalogs and have the lowest cost. Monolithic multilayer inductors offer such performance advantages as higher potential operating frequencies. When you are selecting SMD inductors, you must be concerned with specifications beyond those normally considered important in leaded inductors (inductance, Q, and current-carrying ability). First, you must be sure that the device is compatible with your chosen solder and cleaning process, ie, you must be sure that that process does not destroy the component. Second, you must also check the termination's type and plating to be sure that your solder process produces a reliable connection.

Third, you must note your chosen product's package size for alternate-source compatibility. Fourth, in the case of unshielded, wirewound inductors, you should take note of the winding direction and orientation. This



***Molded surface-mount inductor** (Piconics Inc)*

Wirewound inductors predominate in vendor catalogs, while monolithic inductors offer performance advantages such as higher potential operating frequencies.



***Side-tunable SMD inductors** (Coilcraft)*

last specification is important when you are concerned about mutual inductance between adjacent coils on a tightly packed pc board. Because no standard covers coil orientation (horizontally or vertically) or the direction in which the coils are wound (clockwise or counterclockwise), changing your inductor vendor could greatly affect your circuit's performance; the old and the new devices could have different magnetic linkages.

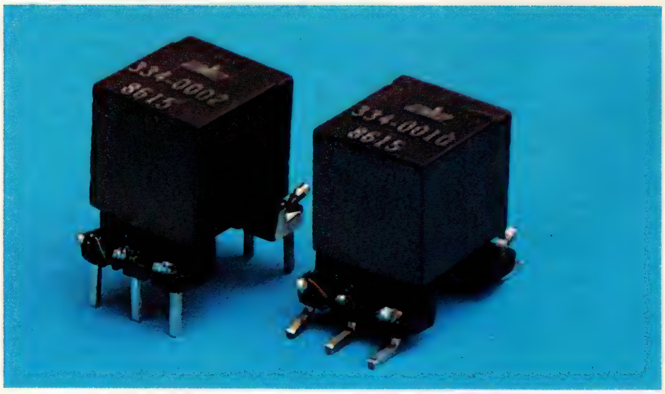
If you decide to use a wirewound SMD inductor, you can select from open-frame, conformally coated, and molded types. For example, SFE Technologies' SMI-B Series inductors feature open-frame construction. The coil is wound vertically on an iron-powder bobbin, and the terminations are constructed by wrapping the wire around the bottom edges of the bobbin and then coating these termination windings with solder. Units from the SMI-B Series cost $0.20 each (1000). The flat top of the SMI-B's vertical bobbin is ideal for vacuum pickup by a pick-and-place machine.

Standex MC microcoils are conformally coated SMD inductors available in four styles: low profile (MC1), standard (MC2), high Q (MC3), and high inductance (MC4). All of these parts are horizontally wound on a U-shaped bobbin, feature plated pads to prevent leaching, and will withstand 240°C for three minutes. You can obtain either epoxy-coated (-E suffix) or potted (-P suffix) devices. Potted versions have a smooth, flat top to facilitate manipulation by the vacuum nozzles of pick-and-place assembly machines. As an example of pricing, inductors from the MC2 Series cost $0.50 (1000). All MC components are optionally available on tape and reel.

Coilcraft offers fixed-inductance, conformally coated, wirewound coils in two sizes. The 1008 inductors are smaller than the 1611 parts and are wound on alumina ceramic forms for inductances to 1 μH or on ferrite forms for inductances between 1.2 and 10 μH. The larger 1611 Series parts are all wound on ferrite forms. Components in both the 1008 and 1611 series are horizontally wound, feature silver-metallized terminations with a solder coating, and cost $0.60 each (1000). The parts will withstand 200°C continuously and 260°C for 10 sec. Coilcraft offers a C100 experimenter's kit of 1008 and 1611 inductors with six pieces in each of 64 inductance values from 4 nH to 1000 μH. The kit costs $125.

You can choose molded, wirewound SMD inductors from a variety of sources. Dale's IMC-2014 Series inductors are compatible with wave, vapor-phase-reflow, and infrared-reflow soldering processes. They feature solder-coated, phosphor bronze terminations and cost $0.60 (1000). Delevan offers molded SMD inductors in both shielded and unshielded versions as the 1330 and 1331 series, respectively, along with the smaller, unshielded 0820 Series inductors. Components in all three Delevan SMD inductor series have cross-shaped, solder-coated, beryllium copper terminations, so you can mount any of four package sides to your pc board. The 0.1-μH inductors in the 1330 and 0820 sizes cost $0.31 and $0.36 (5000), respectively. Toko America's 32CS Series is a low-cost line of very small, molded SMD inductors designed for wave soldering. The 32CS inductors cost $0.25 (5000).

***Through-hole and surface-mount transformers** (AIE Magnetics)*



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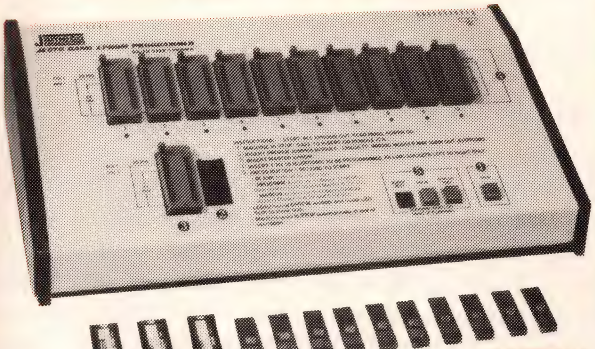

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CIRCLE NO 129

Partly because of low demand, tunable SMD inductors are not as plentiful as the fixed-inductance variety.

Monolithic multilayer inductors have very small geometries, a rugged construction, and are well suited to circuits that operate at extremely high frequencies. Thinco offers three series of multilayer SMD inductors, which have self-resonant frequencies to 6 GHz: The L-30C, L-55C, and L-100C cost $9.73 to $36.89 (100). The fabrication process marks a departure from conventional techniques. The devices are made from a thin-film, vacuum process that deposits alternating layers of aluminum and dielectric on a ceramic substrate. The completed component is encapsulated in a gas-tight layer of glass. Solder-bump terminations allow you to attach the device to your pc board by means of reflow solder techniques.

Partly because of low demand, tunable SMD inductors are not as plentiful as the fixed-inductance variety. Even so, a wide diversity of sizes, shapes, and performance characteristics is evident. Piconics offers the PGV, PSV, and PVW series of tunable SMD inductors. PGV and PSV devices are molded units designed for top and side screw adjustment, respectively. Both are reflow solderable and cost $28.61 (100) at inductance values below 10 μH. The PVW Series is a conformally coated, side-tunable inductor and costs $13.41 (100) at inductance values below 10 μH. Vanguard offers the side-tuned 29,000 Series and top-tuned 31,000 Series of SMD inductors. Both feature molded construction and solder-coated phosphor bronze terminations. Prices range from $7.98 to $10.89 (1000), depending on the inductance value.

For more information . . .

For more information on the surface-mount inductors described in this article, circle the appropriate numbers on the Information Retrieval Service card or contact the following manufacturers directly.

AIE Magnetics
701 Murfreesboro Rd
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Coilcraft
1102 Silver Lake Rd
Cary, IL 60013
(312) 639-6400
Circle No 522

Dale Electronics Inc
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Yankton, SD 57078
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Circle No 523

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Circle No 525

SFE Technologies
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Tucson, AZ 85706
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Standex Electronics
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Cincinnati, OH 45209
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Circle No 528

Thinco Div
Hull Corp
333 Byberry Rd
Hatboro, PA 19040
(215) 672-7800
Circle No 530

Toko America Inc
1250 Feehanville Dr
Mount Prospect, IL 60056
(312) 297-0070
Circle No 531

Vanguard Electronics Co Inc
1480 W 178th St
Gardena, CA 90248
(213) 323-4100
Circle No 532

Coilcraft offers two side-tuned SMD inductors: the 2312MO, which you tune with a hex wrench, and the 3714MI, which has a screwdriver tuning slot. Both series are conformally coated and are compatible with wave, vapor-phase-reflow, and infrared-reflow soldering techniques. The parts will withstand 200°C continuously and 260°C for 10 seconds. For $50 you can purchase the Coilcraft C101 experimenter's kit that contains 45 tunable SMD inductors with values of 100 nH to 10 μH.

Toko America offers several types of tuned SMD inductors. The 5CB Series is a top-tuned SMD inductor packaged in a metal can and available with nominal inductances from 0.02 to 1 μH. The device is suited to reflow soldering and costs $0.72 (5000). The slightly larger 5CD part is also a top-tuned inductor in a metal can, comes with nominal inductances from 1 to 500 μH, and is available with an optional, integral parallel capacitor. The 5CD inductors cost $0.88 and $0.80 (5000) with and without the integral capacitor, respectively.

Beyond simple inductors, transformers are also starting to appear in SMD packages. AIE Magnetics's SMTransformer Series is a standard line of pulse and wideband transformers that come in both through-hole and surface-mount versions. The winding form has a ferrite core and features flat surfaces to facilitate handling by robotic pick-and-place equipment. AIE will form the leads for through-hole applications, or in a gull-wing or J-lead configuration for surface mounting and reflow soldering. You can order custom configurations using the same winding form. The device measures 0.725×0.420×0.550 in. and costs approximately $4.50 (1000). **EDN**

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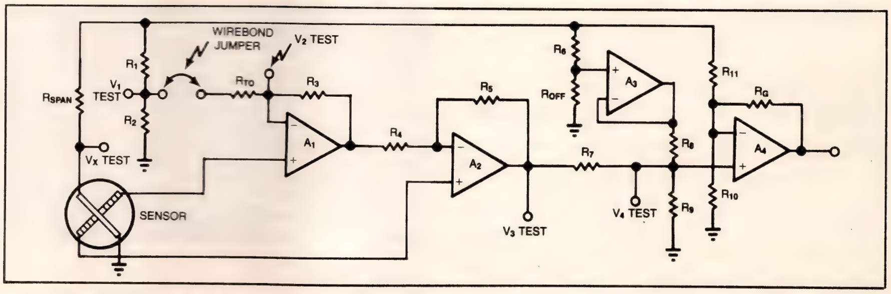
IC-type pressure transducers offer conditioned, high-level linear outputs



Completely integrated on one chip, MPX3100 Series pressure transducers provide temperature-compensated, calibrated, and signal-conditioned high-level linear outputs that are suitable for interfacing directly with A/D converters. The heart of the transducers is a transverse voltage strain gauge—a single piezoresistor in a cruciform (X) shape that replaces the 4-element Wheatstone bridge circuit found in most semiconductor-based transducers.

MPX3100 Series transducers, which cost $62 (100), have a 0 to 15 psi (0 to 100 kPa) measurement-range capability. Their typical burst pressure specs at 150 psi, and their full-scale span ranges from 2.9 to 3.1V. The sensors' zero pressure offset equals 0.6V max. Typical sensitivity specs at 30 mV/kPa, and linearity measures ±0.2% FS typ.

MPX3100 Series transducers are available in differential and gauge configurations. They come in a basic-element package (MPX3100D) or in a housing that includes pressure fittings and offers differential (MPXS3100DP), gauge (MPX3100-GP), or gauge-vacuum (MPX3100-GVP) measurement capabilities. The plastic ports accept standard ⅛-in. ID tubing and are molded from high-temperature thermoplastic that can withstand temperature extremes from −40 to +125°C.

Motorola Semiconductor Products, Box 2953, Phoenix, AZ 85008. Phone (602) 244-6900.

Circle No 536

Stainless-steel membrane keyboards suit application in harsh environments

Impervious to most cleaning solvents, oil, water, acids, and alkalines, Series MT-8700 stainless-steel membrane keyboards are suitable for use in industrial controls, food processors, aircraft, medical instruments, and other applications that are subject to extreme environmental conditions. The keyboards offer four switch-contact configurations: spst-NO (Form A), spst-NC (Form B), spdt (Form C), and dpdt (Form 2C).

Unlike standard polycon membrane switches, stainless-steel switches are impervious to ultraviolet rays. The etched keyboard characters are scratch resistant; multicolored keys and a nonglare surface are optional.

Electrical specifications for the keyboards include 0.1Ω contact resistance, and 10-MΩ insulation resistance at 100V dc. The switches' current rating is 200 mA at 6V dc. For termination, the keyboards are available with connectors or pins.

Activating a key requires 6 to 12 oz of force; key travel distance is 0.015 in. The keyboards offer minimum lifetime specs of 3 million cycles per key and operate over −20 to +125°C. They can withstand 95% relative humidity at 50°C for 15 days.

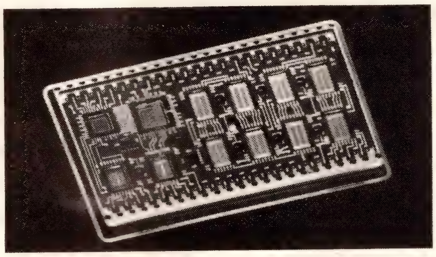
Pricing for the keyboards depends on the switch type and number of stations you choose. In quantities of 1000, 12-station keyboards cost $18.60 (Form A) to $42.50 (Form 2C). For 16-position keyboards, the respective prices are $24.75 and $56.50.

DPI Laboratories Inc, Membrane Technology Div, 359 S Rosemead Blvd, Pasadena, CA 91107. Phone (818) 449-6022.

Circle No 534

Components

CMOS hybrid circuit makes MIL-STD-1553B interface circuit look like μP peripheral



The CT1800 hybrid interface circuit supplies the arbitration and data-transfer links between a MIL-STD-1553B bus system and a μP-based computer. The device appears to the μP as a standard read/write memory location, so the CPU transfers data to and from it using standard memory-mapped I/O techniques. Internal FIFO memories buffer the commands and data going to and from the CPU and the interface circuits.

The hybrid circuit's internal memory and registers relieve the CPU of performing timing operations critical to proper 1553B bus operation. For example, double-buffered registers let the CPU obtain one word from the bus while the device receives the next one. The circuit provides a dual-port 2k-byte (1k-word) CMOS RAM for its receiver and transmitter sections. Each section stores as many as 30 full messages.

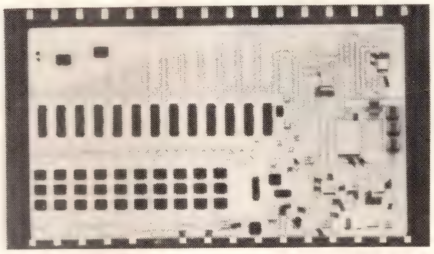
All I/O and control signals for I/O operations are TTL compatible, and they support standard memory-mapped, I/O, or DMA data-transfer operations. Additionally, you can program the 3-state data-bus lines for either two 8-bit transfers or one 16-bit transfer. The data-transfer timing operations are compatible with μPs like the Fairchild F9450A that have short or no hold-time write cycles.

The circuit operates over the military temperature range (−55 to +125°C) and requires one 5V power supply that provides 100 mA. In its standby mode, the chip draws 50 mA. The manufacturer sells two versions of the interface hybrid circuit: The CT1800 contains internal RAM, and the CT1801 lets you add off-chip memory such as nonvolatile RAM. Both hybrids are available in either 90-pin DIPs or 88-pin, 50-mil flat packs. The CT1800, $1250; the CT1801, $1150.

Circuit Technology Inc, 160 Smith St, Farmingdale, NY 11735. Phone (516) 293-8686.

Circle No 537

Successive-approximation A/D converter delivers 12-bit output in 1.56 μsec



Model HAS-1202A 12-bit hybrid D/A converter converts in 1.56 μsec max. A high-speed, current-output D/A converter works in conjunction with a successive-approximation register and a comparator. The device also contains timing circuitry, as well as a voltage-reference block that imparts a 10.24V full-scale analog-input range to the converters.

If the 10.24V input range seems unusual (most converters use a multiple of 5V), note that this range yields a least significant bit (LSB) of exactly 2.5 mV vs the 2.44 mV that's inherent in a 10V-range converter. By connecting the appropriate pins, you can configure the device's input for either 0 to 10.24V unipolar or ±5.12V bipolar input ranges. Output coding is straight binary.

Capable of operating at conversion rates as high as 641 kHz, the HAS-1202A can digitize input signals possessing frequency components as high as 320 kHz. Note that to obtain this digitizing rate, you must use a track/hold amplifier. The manufacturer's HTC-0300A track/hold amplifier is suitable for this purpose, as is the industry-standard 4860 type.

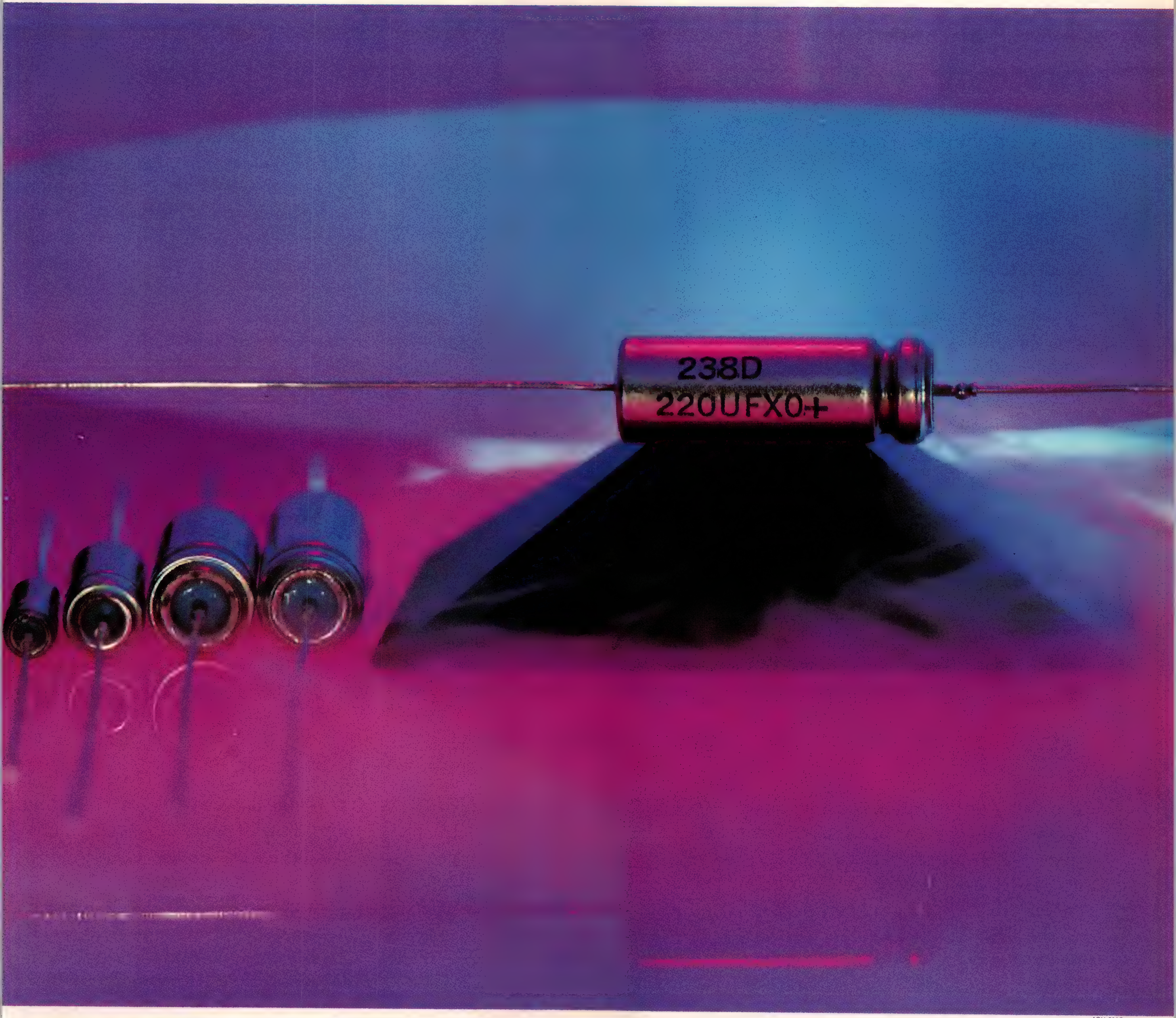
The 1202A offers no missing codes at 25°C. Typical integral and differential nonlinearity at 25°C is ±½LSB, and linearity drift is 3.5 ppm/°C typ.

Available for operation over three temperature ranges (0 to 70°C, −25 to +85°C, and −55 to +100°C), the HAS-1202A comes in a 32-pin ceramic or metal DIP. Units that operate over −55 to +100°C receive screening to MIL-STD-883. Operating from ±15 and 5V supplies, the converter dissipates 1.9W max. From $175 (100).

Analog Devices Literature Center, 70 Shawmut Rd, Canton, MA 02021. Phone (919) 668-9511.

Circle No 533

NEW CAP CUTS COST.



4SX-6115

SPRAGUE TAKES TANTALUM PRICE/PERFORMANCE LEAD.

Sprague takes the price/performance lead with Type 238D Tantalex® capacitors. This new tantalum-based metal-case capacitor features exceptional CV efficiency and a 1-volt reverse capability at +85°C. Reliable operation and high performance are achieved through rugged construction, a hermetic anode seal, and through use of the tantalum-based metal case, which eliminates metal migration. Type 238D tantalum capacitors are manufactured to meet the requirements of MIL-C-39006/26. Mil-qualified units (CLR75) are available. Standard ratings range from 2200 μF at 6 WVDC to 39 μF at 150 WVDC. For Data Sheet 3706, write to Technical Literature Service, Sprague Electric Company, 41 Hampden Rd., P.O. Box 9102, Mansfield, MA. 02048-9102.

Sprague Electric Company, a Penn Central unit. Tantalum Capacitor Operations, North Adams, MA., Sprague World Headquarters, Lexington, MA.

SPRAGUE
THE MARK OF RELIABILITY

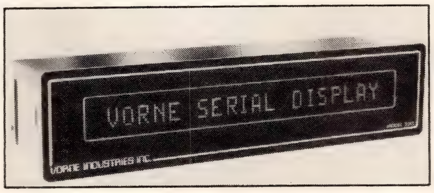
CIRCLE NO 132

Components

Three vacuum-fluorescent displays operate with standard serial-output signals

Three vacuum-fluorescent-display modules operate over a 2-wire bus by using either TTL, current-loop, RS-232C, RS-422, or RS-485 signals. Each module displays as many as 20 alphanumeric characters, each in a 5×7-dot matrix. Character height is 0.2 in. for the Model 2005S, 0.35 in. for the Model 2009S, and 0.59 in. for the Model 2015S display. Each character position displays any one of the 128 standard ASCII symbols.

Each display contains a plug-in communication board that determines the type of serial input the unit accepts and the output it transmits. The display modules act as repeaters by retransmitting serial information to other modules connected in a daisy-chain fashion. The repeater operation helps you overcome distance limitations imposed by line-driver circuits.



The transmission circuit in each module lets you set serial-data characteristics: bit rate, stop bits, parity bit, and a line-termination character. Bit rates range from 300 to 9600 bps. Setting a module's address switches to a nonzero value lets you uniquely address as many as 98 displays connected in a daisy-chain configuration. Additional commands let you flash a message at one of 10 rates. You can also alter a display's brightness by sending it a special code.

Modules are available with or without a bezel and a case. The encased module offers a 120V ac power option. All other configurations require a 5V power supply. Model 2005S, $255.

Vorne Industries Inc, 5831 Northwest Hwy, Chicago, IL 60631. Phone (312) 775-9440.

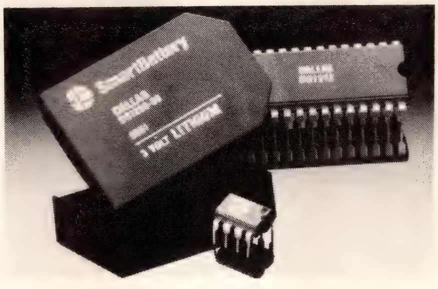
Circle No 542

CMOS chip set monitors for power failures and protects against data loss

Providing orderly shutdown and automatic restart for μP-based systems, the Integrated Battery Backup (IBB) 3-part chip set protects critical data during a power loss.

The IBB comprises the DS1231 power monitor, the DS1260 SmartBattery, and the DS1212 nonvolatile controller/decoder. The DS1231 monitors the high-voltage inputs to your system's power supply and unconditionally halts the μP when V_{CC} falls below a user-selectable 5 or 10% voltage threshold. By halting μP activity before an actual power failure, the DS1231 gives the processor time to store data in nonvolatile RAM.

When the line voltage returns, the DS1231 continues to hold the μP inactive until power conditions stabilize, thus preventing the processor from accidentally emitting write signals, which could change the data stored in RAM. When line power meets the power monitor's nominal specifications, the chip restarts the μP. You can interface a UL-approved optoisolator directly to the DS1231.



The DS1260 SmartBattery's encapsulated lithium energy cell refreshes RAM data during a line-voltage power loss. As soon as V_{CC} exceeds the 3V battery output, the line voltage again supplies power to the system. The chip maintains its 3V potential. Capable of providing more than 10 years of power, the 3V SmartBattery comes in 250, 480, and 960 mAhr capacities.

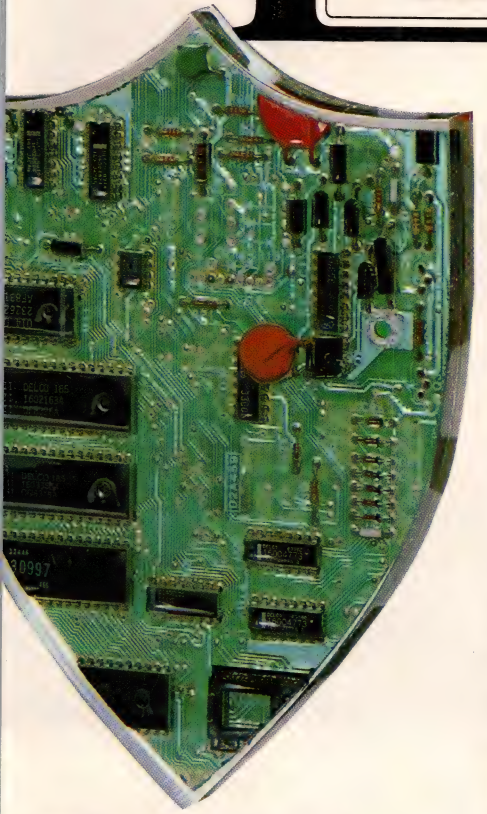
The DS1212 nonvolatile controller/decoder converts as many as 16 CMOS static RAMs to nonvolatile memories by automatically switching supply voltage from V_{CC} to the DS1260 when a power failure occurs. Like the DS1231 power monitor, the DS1212 monitors incoming power for any out-of-tolerance condition. If it detects such a condition, the DS1212 inhibits its chip-enable pins, providing write protection for the RAMs. DS1231, $3.30; DS1260, from $8.75; 16-RAM DS1212, $6.70 (1000).

Dallas Semiconductor Corp, 4350 Beltwood Parkway, Dallas, TX 75244. Phone (214) 450-0400.

Circle No 535

Dow Corning Presents

The Guide to Total Electronics Protection



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CIRCLE NO 13

Fast-cure coating for fiber optics.

OPTIGARD™ optical fiber coating UV-cures in just 0.3 seconds—5 to 20 times faster than thermal-curing coatings. And it protects against moisture and "microbends" better than acrylate coatings. It's part of the OPTIGARD family which includes fiber optics grade $SiCl_4$ core and cladding and OPTIGARD 5565 cable filler.

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CIRCLE NO 91

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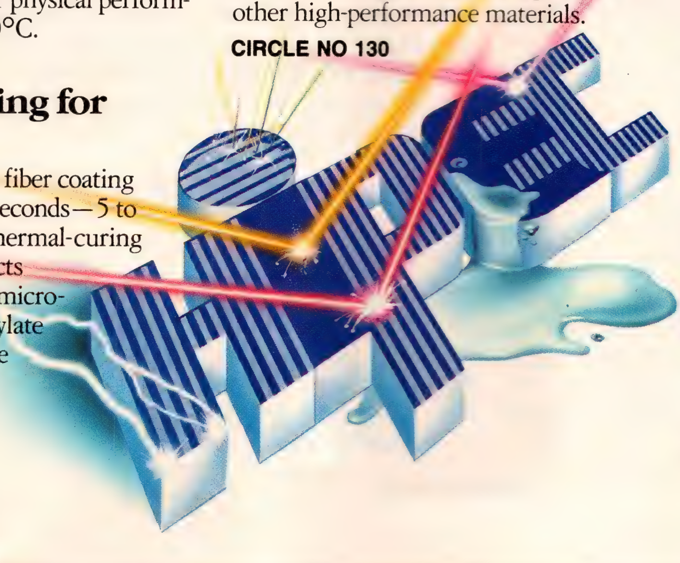
CIRCLE NO 130



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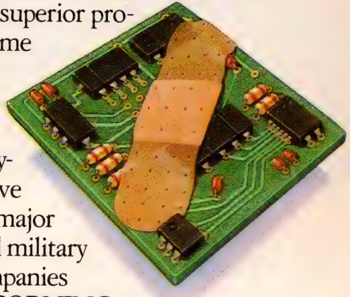

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Midland, MI 48686-0994.

CIRCLE NO 208

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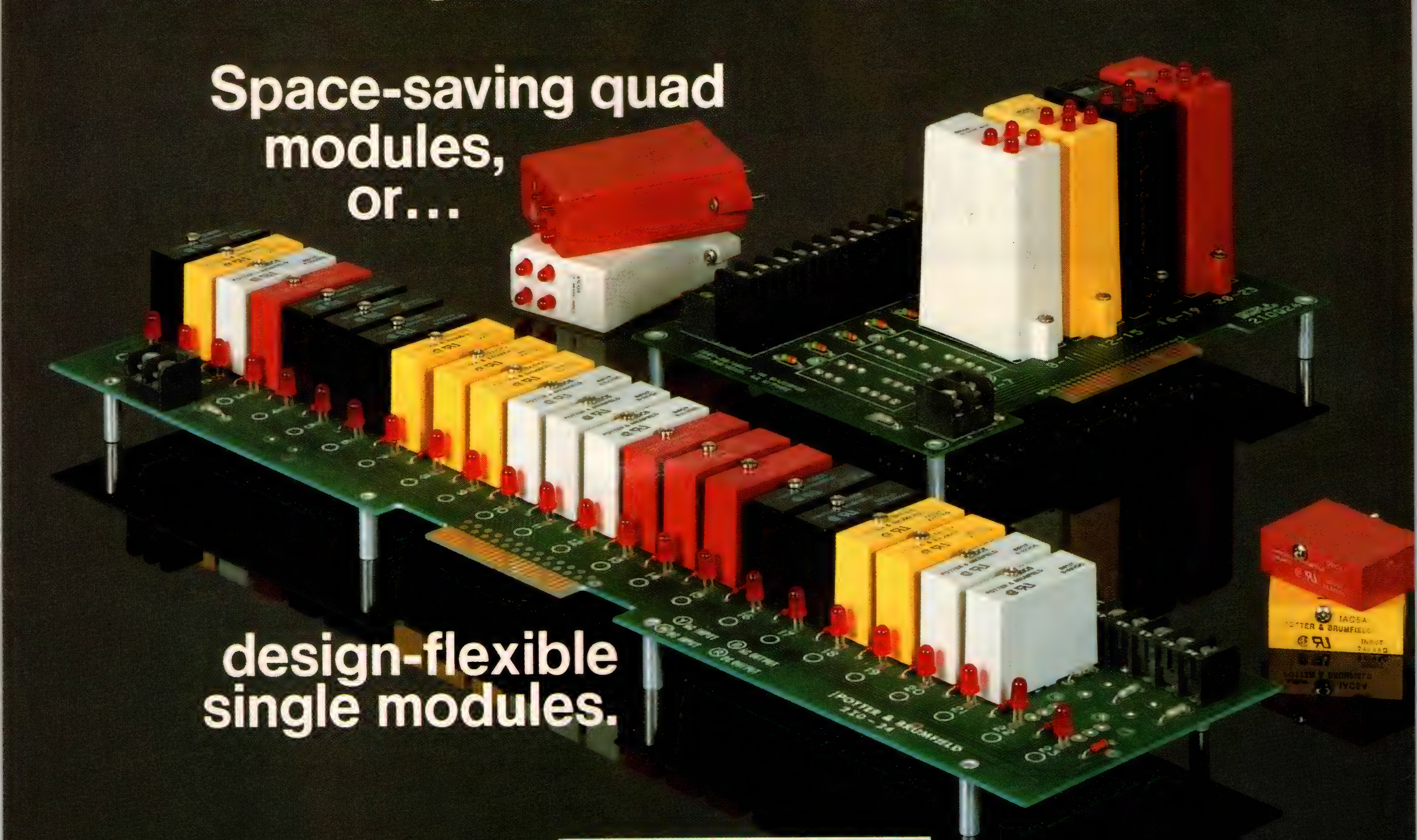
P&B offers you the I/O options you need!


Space-saving quad modules, or...
design-flexible single modules.
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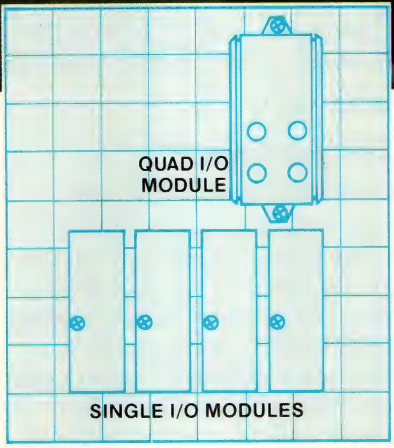


P&B's compact, quad input/output modules are perfect for your industrial control applications with limited space available for interface devices. Each quad module has four I/O channels in a single, plug-in package. An LED indicator is provided for each channel, and modules are color-coded by function.

For designs requiring even more flexibility, our single I/O modules provide single channel pluggability in four photo-isolated, color-coded versions.

Both types reliably interface microprocessor- or computer-based systems with "real world" input devices and loads. Models for use with 5, 15, and 24 volt DC logic systems are in stock. And they have advanced features which many competitors' units lack.

All our I/O modules are highly immune to EMI-induced false operation. They withstand noise levels greater than 3,000 volts, peak-to-peak, without false operating, per NEMA ICS 2-230 (Electrical Noise Immunity Test). This minimizes load half-cycling and helps keep false signals out of the logic system.

Plus, P&B I/O modules are series operation compatible. Input and output modules are fully compatible, so a series-connected input module turns off when the output module turns off—ideal for load-monitoring applications.

We also offer a complete line of mounting boards for single and quad I/O modules. All are UL recognized and CSA certified.

Find out more about P&B I/O products. For the name of your nearest authorized stocking distributor or sales representative, call toll-free **800/255-2550.** Potter & Brumfield, A Siemens Company, 200 S. Richland Creek Drive, Princeton, IN 47671-0001.

Regional Sales: Braintree, MA, 617/848-6550; San Juan Capistrano, CA, 714/493-4503; Princeton, IN, 812/386-2130.

8606

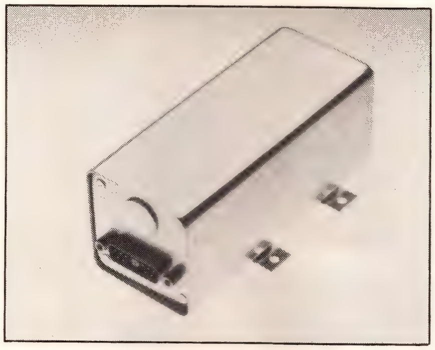
Potter & Brumfield

CIRCLE NO 133

Stable 10-MHz oscillator includes oven and temperature controller

The FTS-2000 Series of environmentally hardened crystal oscillators features an stress-compensated-cut crystal, which provides rapid warmup, short-term stability, and high spectral purity. The stress-compensated quartz crystal exhibits high immunity to thermal stress, thus allowing the oscillator to warm up quickly without exhibiting excessive frequency overshoot.

The oscillator's solder-sealed enclosure includes a crystal oven that controls the temperature of the crystal oscillator and the oscillator's circuit. The oven includes its own control circuitry and VMOS transistor heaters. A temperature-monitor output signal is available for external monitoring. The oven requires a voltage between 18 and 33V, and the oscillator operates from 13 and 18V. Operation from one 18 to 30V power supply is available as an option. Typical warmup power is 14W, but continuous use at 25°C requires only 3W of power.



The oscillator provides a stable output to within 1×10^{-8} within 10 minutes of power-up. Short-term stability reaches 5×10^{-12} over a 10-sec period, and the oscillator's aging rate is less than 5×10^{-10} per day.

The oscillator's output exhibits low phase noise ranging from −90 dBc at 1 Hz to as low as −150 dBc at 1000 Hz. The frequency output is available as a 0.5V rms signal at a coaxial connector. The stock version of the oscillator provides a 10-MHz signal. Frequencies between 4 and 16 MHz are available on special order. $1800.

Frequency and Time Systems Inc, 34 Tozer Rd, Beverly, MA 01915. Phone (617) 927-8220. TLX 940518.

Circle No 543

Sampling 12-bit A/D converters feature internal transparent T/H amplifier

The MN6227 and MN6228 12-bit sampling A/D converters include an internal track/hold amplifier that lets them sample data at rates as high as 33 kHz. When sampling and digitizing at that rate, both devices maintain a minimum 70-dB min signal-to-noise ratio and a −80-dB min harmonic distortion. You can select either unipolar or bipolar input-voltage ranges for both converters: 0 to 10V or ±5V for the MN6227 and 0 to 20V or ±10V for the MN6228.

The converters' 3-state output pins let you connect them directly to either 8- or 16-bit computer buses. The converters' chip-select, chip-enable, and read-convert signals are TTL compatible.

The high-impedance, high-speed T/H amplifier furnishes a 40V/μsec slew rate and a ±0.005% linearity error (max). The amplifier's aperture jitter is 0.5 nsec, and its hold-mode feed through attenuation is −80 dB.

The T/H amplifier's errors add to the corresponding errors from the A/D converters. However, the manufacturer effectively nulls the errors by functionally laser-trimming the linearity and accuracy of the converters. The manufacturer laser-trims the A/D converters' offset while the converter operates at its 33-kHz sampling rate. Trimming takes place when the T/H amplifier is in the hold mode.

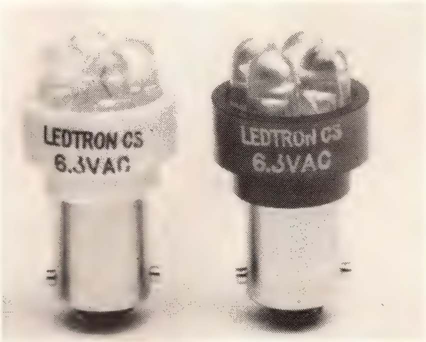
The converters are available in 11- or 12-bit no-missing-code versions. You can also select versions that operate over 0 to 70°C or −55 to +125°C temperature range. High-reliability screening to MIL-STD-883, Method 5008 is available at extra cost. The 12-bit successive-approximation A/D converter circuit includes an internal reference and clock. Prices for 12-bit no-missing-code converters start at $84 (100).

Micro Networks, 324 Clark St, Worcester, MA 01606. Phone (617) 852-5400.

Circle No 541

LEDs provide high-brightness indicators in T3¼ bayonet lamp bases

The Model B304 family of red LED clusters lets you directly substitute high-brightness LEDs for standard T3¼ bayonet-type incandescent indicators. The LEDs are directly interchangeable with incandescent lamps, such as types 6MB, 12MB, 755, 1866, 1819, 43, and 47. Typical applications for the LED clusters include use in illuminated controls, switches, pilot lamps, and panel indicators that provide a translucent or transparent lens. The LEDs illuminate lenses that have a diameter as large as 2 in.



The LED clusters also replace the incandescent lamps in large transformer-driven pilot lights and switches such as the Allen-Bradley 800T Series and in industrial indicators made by companies such as Westinghouse, GE, Cutler-Hammer, Square-D, and others. The clusters withstand extreme temperatures and harsh atmospheric conditions and resist high shock and vibration. Besides the bayonet base, the manufacturer furnishes LED clusters in the T3¼ style with miniscrew or miniflange bases.

In addition to red LEDs, the B304 family includes orange, amber, lime-yellow, and deep-green colors; however, the 16-candela cluster is available in red only. Because the LEDs generate monochromatic light, the manufacturer recommends you substitute white-translucent or water-clear fluted lenses for colored lenses when you replace an incandescent lamp with an LED cluster.

The price for an ultrabright cluster is $4.50 (1000); the 16-candela red clusters cost $18 (1000). Free samples and an LED-to-incandescent lamp cross-reference chart are available.

Ledtronics Inc, 4009 Pacific Coast Hwy, Torrance, CA 90505. Phone (213) 676-7996.

Circle No 538

V/F converter operates to 10 MHz for a 140-dB dynamic range

The 3910 V/F converter accepts a $-100\ \mu V$ to $-10V$ input signal and converts it to an output frequency that's proportional to the unit's full-scale output frequency. Input signals must be single ended. When used as an A/D converter, the unit provides a 140-dB dynamic range along with the same inherent noise rejection of an integrating A/D converter. The V/F converter's effective resolution is 17 bits.

The unit's output is linear to 0.05% of full scale, and its offset is 10 μV/°C typ, 30 μV/°C max. Gain is 60 ppm/°C typ, 100 ppm/°C max. External connections to the 24-pin DIP let you trim both the offset and gain with low-temperature-coefficient potentiometers.

The converter provides complimentary 50-nsec TTL pulse outputs that can drive capacitive loads as high as 50 pF. In the logic-zero state, each output sinks 3 mA. Warmup time is < 2 minutes.

The 3910 is suited for applications that require a wide dynamic range of measurements, such as weighing and telemetry systems as well as analytical and medical instruments. The manufacturer offers custom frequencies and trimming to accommodate fixed offsets or nonstandard input voltages.

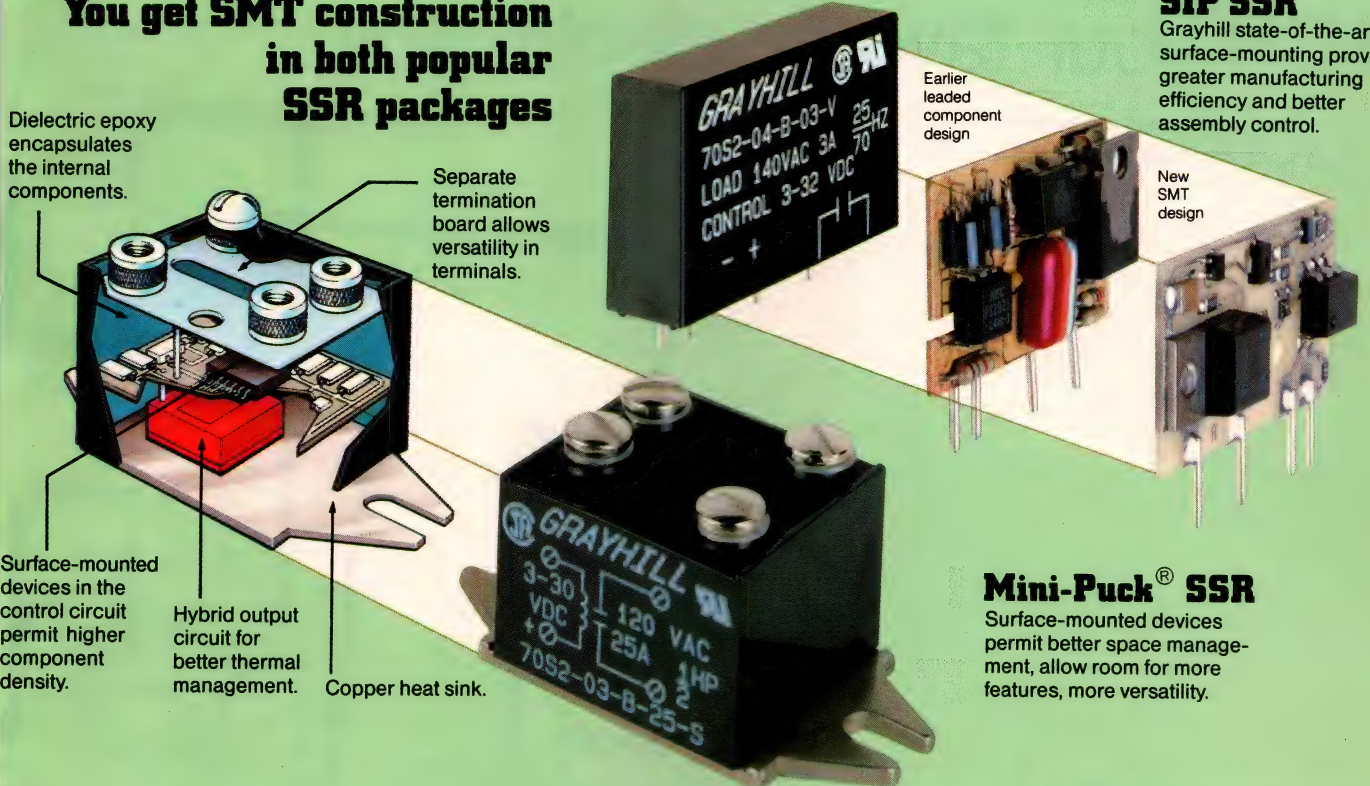
Power requirements are 15V at 30 mA, −15V at 10 mA, and 5V at 50 mA. The unit's power dissipation is 0.85W (max), and it's available in a $1.31 \times 0.69 \times 0.22$-in. dual-width DIP. $78 (100).

Dymec Inc, 8 Lowell Ave, Winchester, MA 01890. Phone (800) 225-1151; in MA, (617) 729-7870. TWX 710-348-6596.

Circle No 544

Grayhill Solid State Relays Provide 100,000 Hours MTBF–AQL of 0.065%

You get SMT construction in both popular SSR packages


Dielectric epoxy encapsulates the internal components.
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Copper heat sink.
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SIP SSR

Grayhill state-of-the-art surface-mounting provides greater manufacturing efficiency and better assembly control.

Mini-Puck® SSR

Surface-mounted devices permit better space management, allow room for more features, more versatility.

1 BETTER QUALITY...AQL OF 0.065%

Surface mount technology allows a tightly controlled and repeatable assembly process. Every SMT-built Grayhill Solid State Relay meets the stated AQL level. Workmanship variations inherent in hand-mounted components are eliminated. The smaller SMD components allow greater spacing within the package size, providing a higher dielectric strength voltage between output and input. And because the relays are potted, they're less susceptible to damage from shock and vibration.

2 BETTER RELIABILITY... DEMONSTRATED 100,000 HOURS MTBF (TEST DATA TO DATE)

An excellent thermal management design, utilizing vapor-phase soldering, maximizes heat transfer between the switching device and the heat sink, allowing high current switching in the least amount of space. Vapor-phase soldering in an inert environment prevents solder joint contamination throughout the relay.

Grayhill selects high voltage breakdown SMD components in all critical areas. Each relay design is tested under "worst case" conditions–the maximum switching current at 100°C–providing reliability test results at the maximum allowable die temperature as well as stressing all other relay components. Tests are run for 2,000 hours (43,000,000 device cycles) at the elevated temperature.

3 BETTER VALUE...COMPETITIVELY PRICED

Labor-saving advantages allow Grayhill to offer these high quality, high reliability, SMT-built solid state relays at competitive prices. A real value from a trustworthy source.

Compare the Grayhill SMT-built, 25amp solid state relay with a similar leaded component relay.

	Leaded components	SMT design
Output circuit		
Load current	12 A max.	25 A max.
Surge current	150 A one cycle	350 A one cycle
Static dV/dT	3,000 V/μsec	4,000 V/μsec
Offset voltage	8 V max.	4 V max.
Thermal resistance	2.4 C/W	1.75 C/W
Zero crossing window	50 V AC	25 V AC
Power factor	0.5 typical	0.4 typical
General characteristics		
Isolation resistance	100 MΩ	1,000 MΩ
Dielectric voltage	2,500 V AC rms	4,000 V AC rms
Input to output capacitance	6 pF typical	4 pF typical

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CIRCLE NO 134

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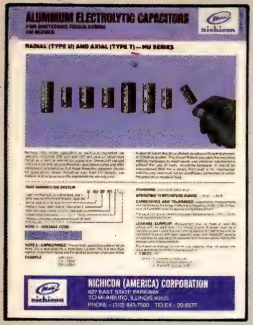
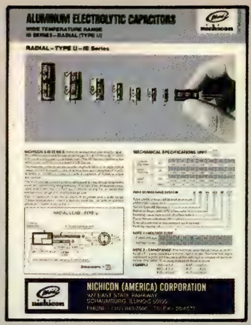
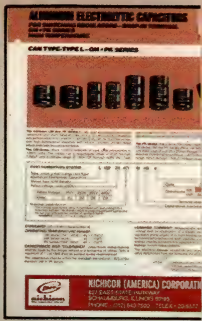
From the staff of EDN



At Nichicon, we want to help you find your capacitor choice.

Miniature Aluminum Electrolytic Capacitors

Series Type	Feature	Operating Temp. (°C)	D.C. Leakage Current (μA)	Construction	Rated Voltage Range (V.DC)	Capacitance Range (μF)	Standard Capacitance Tol. (%)
LB	• Standard Size • General Purpose	−40~+85	0.03CV (A*) (4μA Min.)	Radial (U)	6.3~100	0.1~10,000	±20 (M)
				Axial (T)	6.3~100	0.47~33,000	±20 (M)
VX	• Smaller Standard Size • High CV Density • General Purpose	−40~+85	0.01CV (B*) (3μA Min.)	Radial (U)	6.3~100	0.47~10,000	±20 (M)
HU	• High Voltage	−25~+85	0.06CV +10 (C*)	Radial (U)	160~450	1~100	−10~+50 (T)
				Axial (T)	160~450	1~470	−10~+50 (T)
BU	• High CV Products	−40~+85	0.02CV (C*) (3000μA Max.)	Radial (U)	6.3~100	1,000~3,300	±20 (M)
VS	• Low Profile Design	−40~+85	0.01CV (B*) (3μA Min.)	Radial (U)	6.3~50	0.1~4,700	±20 (M)
KB	• Low Leakage • Tantalum Replacement	−40~+85	0.002CV (B*) (0.4μA Min. −U) (1μA Min. −T)	Radial (U)	6.3~100	0.1~100	±20 (M)/±10 (K)
				Axial (T)	6.3~100	0.47~100	±20 (M)/±10 (K)
SA	• Super Miniature (7mm Height) • Tantalum Replacement	−40~+85	0.01CV (B*) (3μA Min.)	Radial (U)	6.3~50	0.1~100	±20 (M)
SL	• Super Miniature (7mm Height) • Tantalum Replacement • Low Leakage	−40~+85	0.002CV (B*) (0.4μA Min.)	Radial (U)	6.3~50	0.1~100	±20 (M)
SP	• Super Miniature (7mm Height) • Non-Polarized	−40~+85	0.05CV (B*) (10μA Min.)	Radial (U)	6.3~50	0.1~47	±20 (M)
MA	• Ultra-Miniature (5mm Height) • Tantalum Replacement	−40~+85	0.01CV (B*) (3μA Min.)	Radial (U)	4~50	0.1~220	±20 (M)
EB	• Non-Polarized	−40~+85	0.01CV (C*) (5μA Min.)	Radial (U)	6.3~100	0.47~1,000	±20 (M)
				Axial (T)	6.3~100	0.47~3,300	±20 (M)

Miniature High Temperature Capacitors

Series Type	Feature	Operating Temp. (°C)	D.C. Leakage Current (μA)	Construction	Rated Voltage Range (V.DC)	Capacitance Range (μF)	Standard Capacitance Tol. (%)
PC	• Standard Size • Wide Temp. Range • General Purpose	−55~+105	0.03CV (A*) (4μA Min.)	Radial (U)	6.3~100	0.47~10,000	±20 (M)
		−40~+105	0.03CV (A*) (4μA Min.)	Axial (T)	6.3~100	0.47~10,000	±20 (M)
BB	• High Temperature • High Reliability	−40~+105	0.002CV (C*) (2μA Min.)	Radial (U) Axial (T)	10~100	0.47~1,000	±20 (M)
BE	• High Temp. (+125°C) • High Reliability	−40~+125	0.002CV (C*) (2μA Min.)	Radial (U) Axial (T)	10~50	0.47~470	±20 (M)
ST	• High Temp. (+105°C) • Super Miniature (7mm Height)	−40~+105	0.01CV (B*) (3μA Min.)	Radial (U)	6.3~50	0.1~100	±20 (M)

Miniature Special Application Capacitors

Series Type	Feature	Operating Temp. (°C)	D.C. Leakage Current (μA)	Construction	Rated Voltage Range (V.DC)	Capacitance Range (μF)	Standard Capacitance Tol. (%)
PX	• Low ESR • Smaller Package • High Ripple	−55~+105	0.03CV (A*)	Radial (U)	6.3~63	22~2,200	±20 (M)
TM	• For Timing Circuits • Very Stable at High Temp.	−40~+85	0.001CV+1 (B*)	Radial (U)	10~50	1~470	±20 (M) ±10 (K)
HA	• High Frequency, High Ripple	−25~+85	100 (C*)	Radial (U)	25	2.2~10	±10 (K)

Can Type Lytics

Series Type	Feature	Operating Temp. (°C)	D.C. Leakage Current (μA)	Construction	Rated Voltage Range (V.DC)	Capacitance Range (μF)	Standard Capacitance Tol. (%)
HL/LL	• Snap-in Terminal for P.C.B. Mount	−40~+85	$3\sqrt{CV}$ (C*)	Can (L)	16~100	470~22,000	−10~+30 (Q)
UB	• Snap-in Term., P.C.B. Mount • Smaller Size	−40~+85	$3\sqrt{CV}$ (C*)	Can (L)	16~100	1,000~15,000	±20 (M)
NW/NK/NS	• Computer Grade	−25~+85	$3\sqrt{CV}$ (C*) (10mA Max.)	Can (L)	6.3~450	120~1,000,000 (1F)	−10~+50 (T)
PS [LR]	• Snap-in Term, P.C.B. Mount • For Switching Regulators • [Smaller Size]	−40~+85 (160~250) −25~+85 (350~450)	$3\sqrt{CV}$ (C*)	Can (L)	160~450 [400]	47~1,000 [47~330]	±20 (M)
PK	• High Ripple, Switching Reg. • Extended Temp. Range • Snap-in Term., P.C.B. Mount	−40~+105	$3\sqrt{CV}$ (C*)	Can (L)	200~250	150~1,000	±20 (M)
GM [GF]	• High Ripple, Switching Reg. • Extended Temp. Range • Snap-in Term., P.C.B. Mount • [Smaller Size]	−40~+105 (160~250) −20~+105 (400)	$3\sqrt{CV}$ (C*)	Can (L)	160~400 [400]	47~1,000 [47~330]	±20 (M)
FL	• Low Profile (20mm Height) • Snap-in Term., P.C.B. Mount • For Switching Regulators	−40~+85	$3\sqrt{CV}$ (C*)	Can (L)	160~250	82~270	±20 (M)

Class III Semiconductive Ceramics

Series Type	Temperature Characteristics	Rated Voltage (V. DC.)	Capacitance (μF)	Standard Capacitance Tolerance	Insulation Resistance (MΩ)	Dissipation Factor (at 1kHz)
HET	Y5T	12	0.022~0.47	±20% (M) +80~−20% (Z)	12V: 0.022~0.1μF −1 Min. 0.22μF −0.5 Min. 0.33μF −0.33 Min. 0.47μF −0.25 Min. 25V: 0.01~0.22μF −1,000 Min. 0.47μF −500 Min. 50V: −1,000 Min.	12V: 7.0% Max. 25V: 5.0% Max. 50V: 5.0% Max.
		25	0.01~0.1			
		50	0.01~0.1			
HEV	Y5V	12	0.047~0.47			
		25	0.022~0.47			
		50	0.01~0.1			

Polyester Capacitors

Series Type	Rated Voltage (V. DC)	Capacitance (μF)	Standard Capacitance Tolerance	Insulation Resistance	D.F.
QYA	100	0.001~0.47	±5% (J). ±10% (K). ±20% (M)	9.00MΩMin.	1.0% Max. at 1kHz
QXM (Radial)	250, 400, 630	0.01~2.2	±5% (J). ±10% (K) ±20%(M)	≤0.33μF-9.00 MΩMin.	1.0% Max. at 1kHz
QAM (Axial)	250, 400, 630	0.15~10	±5% (J). ±10% (K). ±20% (M)	>.033μF-3,000 MΩMin	
QAL	125V. AC	0.0047~.022	±10% (K). ±20% (M)	9,000MΩMin. at 100 V. DC 1 Min.	1.0% Max. at 1kHz

(A*) = Leakage Current after 1 minute (B*) = Leakage Current after 2 minutes (C*) = Leakage Current after 5 minutes

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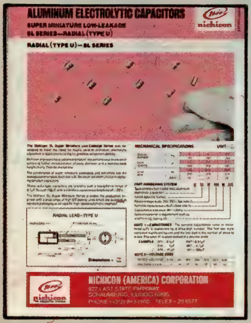
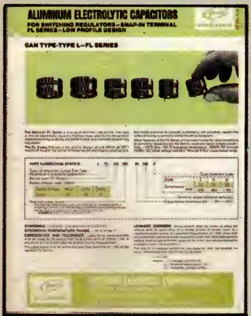
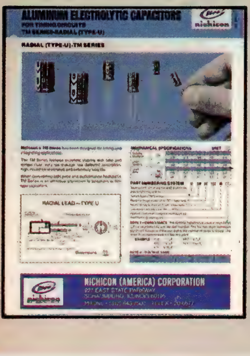
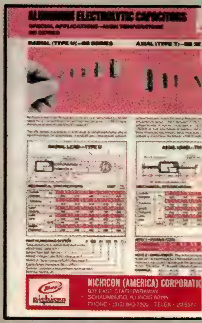
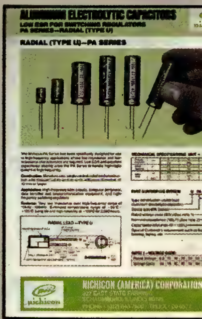
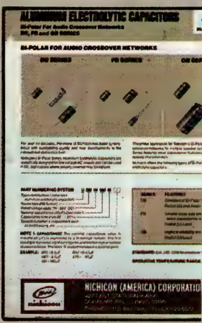
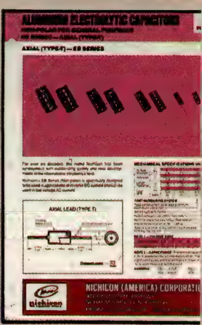
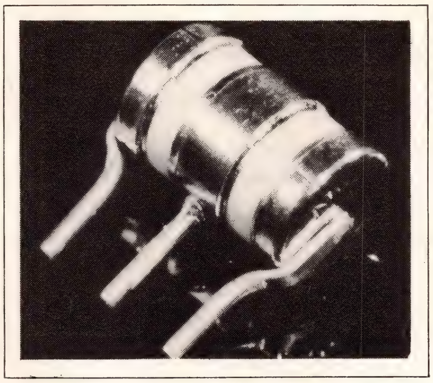




SURGE PROTECTORS

Operating at a 90V sparkover voltage, Alpha units protect circuits from voltage surges and transients. The devices' 3-terminal construction lets them supply balanced protection to data-communication lines. Typical applications include use with low-voltage data lines, process-control sensor lines, and non-dial-up communication lines.

The Alpha units handle a 10-kA discharge current, and their maximum ac-discharge current varies between 10 and 40A, depending on discharge conditions. Gap-to-gap transfer time is 0.15 μsec max.

You can purchase the Alpha units in five configurations, depending on the type of leads you need. The Alpha protectors mount on pc boards; they are compact enough to fit in traditional protection hardware devices such as Western Electric 660 modules. $1.75 (1000).

EEV Inc, 7 Westchester Plaza, Elmsford, NY 10523. Phone (914) 592-6050. TLX 6818096.

Circle No 548

THICK-FILM RESISTOR

This force-sensing resistor comprises a thick film of conductive polymer in contact with two conductors. With no force applied to the device, its resistance is in the megohm range. However, as you apply force to the resistor, it's resistance decreases logarithmically until it reaches a saturation value. At saturation, additional force has no effect on resistance. Because the manufacturer offers a variety of custom devices, you can specify a saturation resistance between 100Ω and 100 kΩ.

The manufacturer supplies the thick-film resistors in either shunt or through-conduction styles. The shunt style provides the thick-film resistor on a sheet of Mylar that presses against two networks of interleaved conductors on a separate sheet of Mylar. As you press the resistor against the conductors, the resistance decreases. In a through-conduction sensor, two Mylar sheets each contain resistive material deposited on top of a thin conductor. When you force the two sheets together so the resistors touch, the resistance decreases.

The resistive polymer lets you operate in three force ranges: switch, log-log, and linear. In the switch range, a load of 30g causes an abrupt 100:1 change in resistance, which you can use to provide on-off signals. Switch repetition rates range from 200 to 1000 Hz.

Samples of sensors, keyboard contacts, and a digitizing tablet start at $10. Individual sensors are available for $0.99 (1000). Screens, production tooling, and artwork-preparation changes are extra.

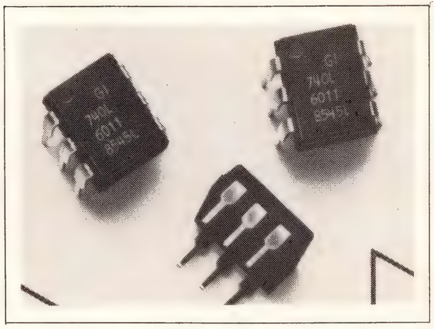
Interlink Electronics Inc, Box 40760, Santa Barbara, CA 93103. Phone (805) 965-5155. TLX 4948534.

Circle No 540

OPTICAL COUPLERS

By eliminating special driver and receiver circuits, the 74OL6000 Optologic family lets engineers use optical couplers directly with TTL and CMOS-logic families. The couplers are already optimized for speed, noise rejection, and minimum power consumption. Input amplifiers ensure compatibility with LSTTL fan-in current requirements (200 μA), and the amplifier's high-impedance input lets you use the couplers as line receivers.

Operating characteristics include a typical propagation delay of 60 nsec, which limits the couplers to a maximum 15M-bps data-transfer rate. The high-insulation, 6-pin package withstands a 2500V rms test voltage for 1 minute, which corresponds to a working voltage of 440V rms. The minimum common-mode transient immunity is 5000 V/μsec. Common-mode noise immunity is 15 kV/μsec.



Each coupler includes three chips: an input amplifier, an output amplifier, and an LED. The output-amplifier chip includes the circuit's photodetector. The couplers let you choose between two output configurations: totem-pole outputs for TTL circuits (74OL6000/01) or open-collector outputs for 4.5 to 15V CMOS levels (74OL6010/11). $2.55 (1000).

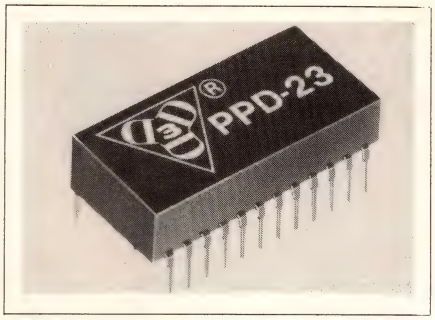
General Instrument Optoelectronics Div, 3400 Hillview Ave, Palo Alto, CA 94304. Phone (415) 493-0400.

Circle No 546

PULSE DISCRIMINATORS

By providing a 3-bit value to the PPD-23 Series programmable discriminator, you set the period for its discriminator circuit. The device passes those signals that exceed the programmed discrimination pulse width while it blocks all other signals. The manufacturer supplies nine versions of the discriminator circuit, with pulse-width increments that range from 1 to 50 nsec.

Discriminator response isn't instantaneous. When the discriminator detects a pulse that exceeds its programmed pulse length, it delays the output pulse by the programmed time plus 6 nsec. Also, the shorter increments can have signifi-



cant errors. For example, the PPD-23-5 offers 5 nsec ±6 nsec increments.

The PPD-23 units require a parallel 3-bit input that selects the incremental pulse width. The control and signal inputs are Schottky-TTL compatible, and two complimentary outputs each drive one Schottky-TTL input.

Available in 24-pin DIPs, the discriminators require 5V and dissipate 850 mW (max). Temperature drift is 100 ppm/°C. $18.75 (100). Delivery, four to six weeks ARO.

Data Delay Devices Inc, 385 Lakeview Ave, Clifton, NJ 07011. Phone (201) 772-1106. TWX 710-989-7008.

Circle No 545

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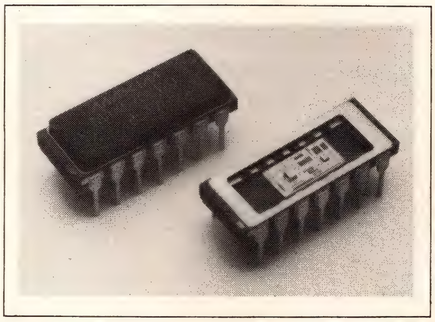


REFERENCE SOURCES

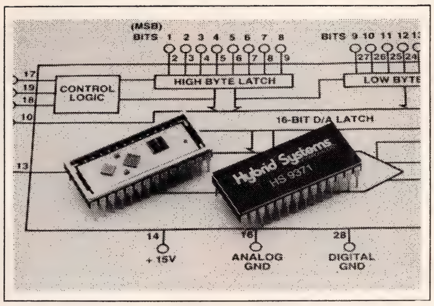
By providing Kelvin connections for both output and ground signals, the MAX670 and MAX671 offer high load and line regulation. The regulation is independent of the impedance between the reference's output and ground. To maintain high precision over commercial, industrial, and military temperature ranges, the manufacturer laser-trims the references for high initial accuracy and low temperature drift.

The MAX671 has a guaranteed 1 ppm/°C max output voltage drift with an initial output accuracy of 1 mV. The MAX670 has a 3 ppm/°C max voltage drift with a 2.5-mV initial accuracy. Both devices furnish an external fine-trim adjustment signal that doesn't disturb the output voltage's temperature coefficients.

Both references feature a 50-μV/V max line regulation, a load regulation of better than 10 μV/mA, and a typical noise specification of 10 μV p-p over the 0.1 to 10-Hz bandwidth. MAX670, from $33.84; MAX671, from $39.80 (100).

Maxim Integrated Products, 510 N Pastoria Ave, Sunnyvale, CA 94086. Phone (408) 737-7600.

Circle No 552



16-BIT D/A CONVERTER

By providing two internal and independent 8-bit latches, the HS 9371 D/A converter readily mates with either 8- or 16-bit data buses. The hybrid circuit furnishes its high- and low-byte data-input pins on opposite sides of its 28-pin DIP, thus easing data-bus connections to pc boards. Logic inputs are compatible with TTL, LSTTL, and CMOS voltage levels. When driven with CMOS logic levels, the hybrid's power consumption is as low as 45 mW.

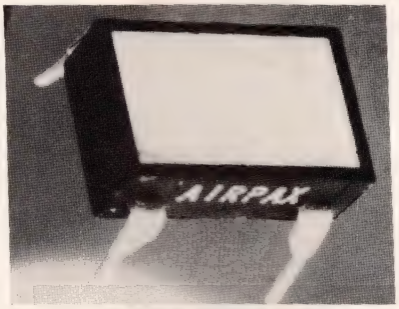
The hybrid D/A converter requires 5V at 20 mA (max) and 15V at 3 mA (max). You must supply an external 10V reference voltage. The converter provides a monotonic output over it's 16-bit range as either a unipolar 0- to 2-mA output or as a ±1-mA bipolar output. A full-scale transition of the output signal into a 50Ω load requires 5 μsec to settle to 0.0015% FS. For a major-carry transition, the device requires only 1 μsec to settle to within 0.0015% FS. The hybrid operates with a maximum differential linearity error of ±0.0015% over its operating temperature range.

The HS 9371K, $65 (100); Model HS 9371TB, screened to MIL-STD-883 specifications, $150 (100).

Hybrid Systems Corp, 22 Linnell Circle, Billerica, MA 01821. Phone (617) 667-8700.

Circle No 539

THERMOSTAT



Available in a 4-pin DIP, the Series 66 thermostat lets you provide a temperature-dependent switch where space is at a premium. The thermostat contains a gold-plated spst switch, which you specify as either an NO or an NC contact configuration.

Typical switch contact ratings are 1A (resistive) at 48V dc for 30,000 cycles or 20 mA at 5V for 100,000 cycles. The thermostat operates between 40 and 120°C in 5°C increments (±5°C). Because the thermostat isolates its temperature-sens-

Continued on pg 217

Bliley

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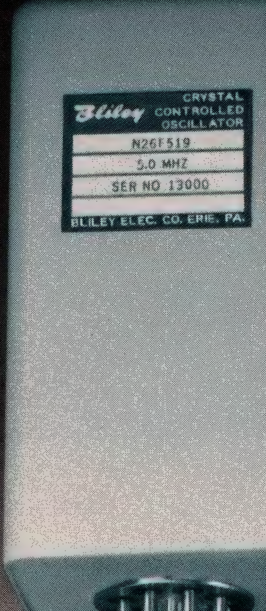
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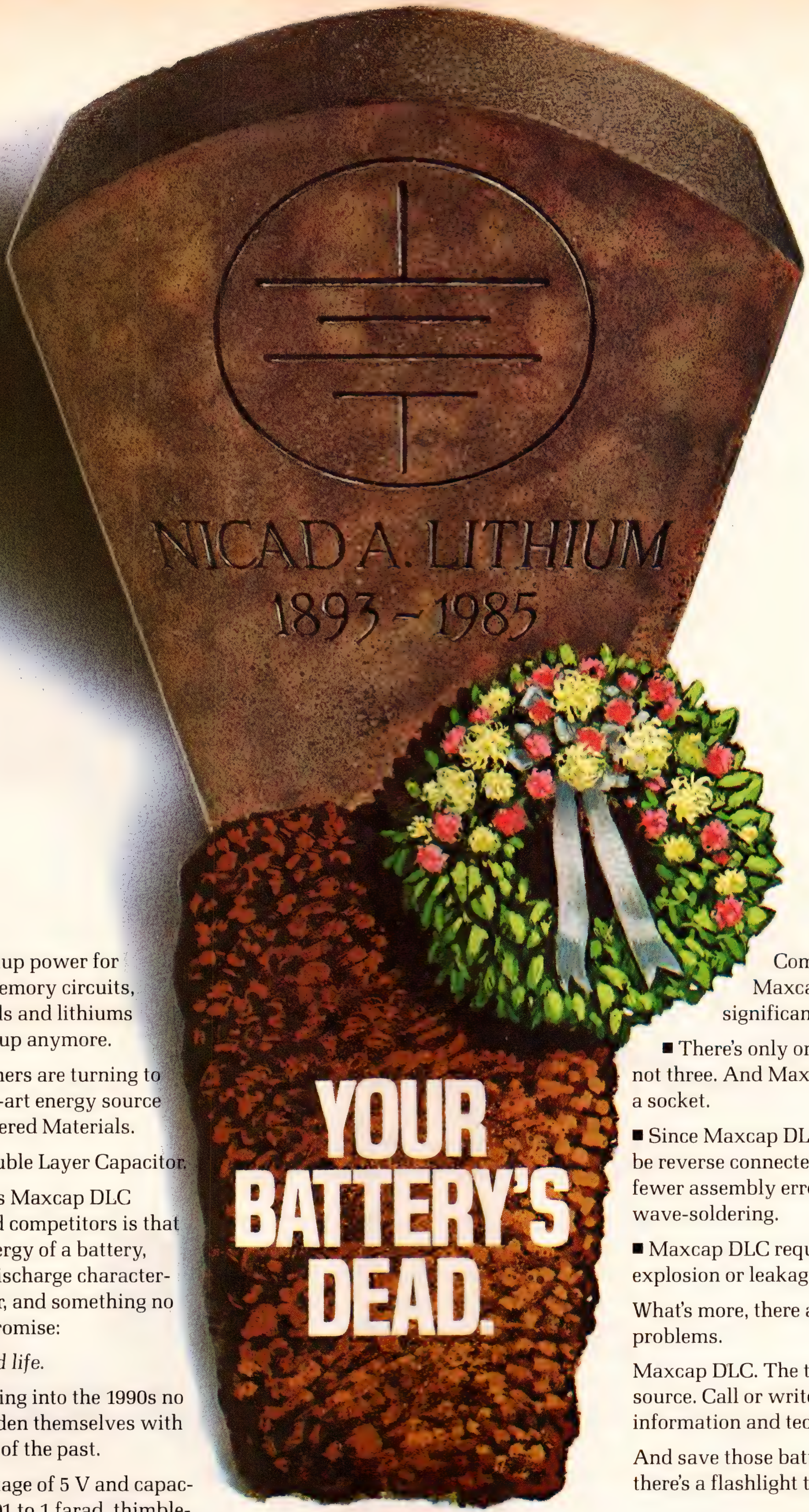

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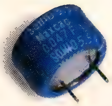

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At its nominal voltage of 5 V and capacitance values of 0.01 to 1 farad, thimble-size Maxcap DLC can be charged and discharged indefinitely without maintenance or replacement. Since there's no need for access, equipment can be made smaller and simplified. You can also reduce backup circuit and assembly costs.

Compared to batteries, Maxcap DLC delivers these significant cost savings:

- There's only one extra component, not three. And Maxcap DLC doesn't need a socket.
- Since Maxcap DLC is nonpolar, it can't be reverse connected, so you'll have fewer assembly errors. And you can use wave-soldering.
- Maxcap DLC requires no toxicity, explosion or leakage safeguards.

What's more, there are no disposal problems.

Maxcap DLC. The timeless energy source. Call or write for complete information and technical details.

And save those batteries. Somewhere, there's a flashlight that can use them.

Sohio Engineered Materials Company
Semiconductor Products Division
P.O. Box 664
Niagara Falls, NY 14302
716/278-3954

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Engineered Materials
Company**

SOHIO

Maxcap DLC shown actual size above.

CIRCLE NO 140

How much do we want your snap switch business?

We'll tell you why doing business with Unimax is worth more to you. We'll give you all the benefits you expect from a major switch supplier. And more.

Like switch performance you can take for granted, because we don't. Delivery dates you can arrange and then forget, because we won't. Custom engineering that meets your designs, not ours. And prices that, quite simply, make our competition sweat.

To discover why Unimax should be your complete source for switches, just ask us!

Call for the location of your nearest distributor or sales representative.

Unimax Switch

Ives Road, Wallingford, CT 06492. (203) 269-8701.

ing element from the switch, the temperature setpoint doesn't vary as you change the unit's load current.

The switch housing is compatible with automatic-insertion equipment and is sealed to withstand wave soldering and board washing. $5.20 (500). Samples are available from stock. Delivery, eight to 10 weeks ARO.

Airpax Corp, Box 868, Cheshire, CT 06410. Phone (301) 663-5141.

Circle No 551

FAST 12-BIT ADCs

Featuring low initial offset and gain errors of 3 LSBs, the ADC-500 converts voltages to 12-bit binary codes in 500 nsec; the ADC-505 performs a conversion in 550 nsec. External pins let you program the converter for 0 to 10V, 0 to 20V, or ±10V inputs. Input impedance is 3.5 kΩ for unipolar ranges and 1.75 kΩ for the bipolar range.

Maximum nonlinearity is ±½ LSB and harmonic distortion is 72 dB below full scale. The converter boasts a ±35 ppm/°C gain temperature coefficient and a ±2 ppm/°C max differential linearity temperature coefficient.

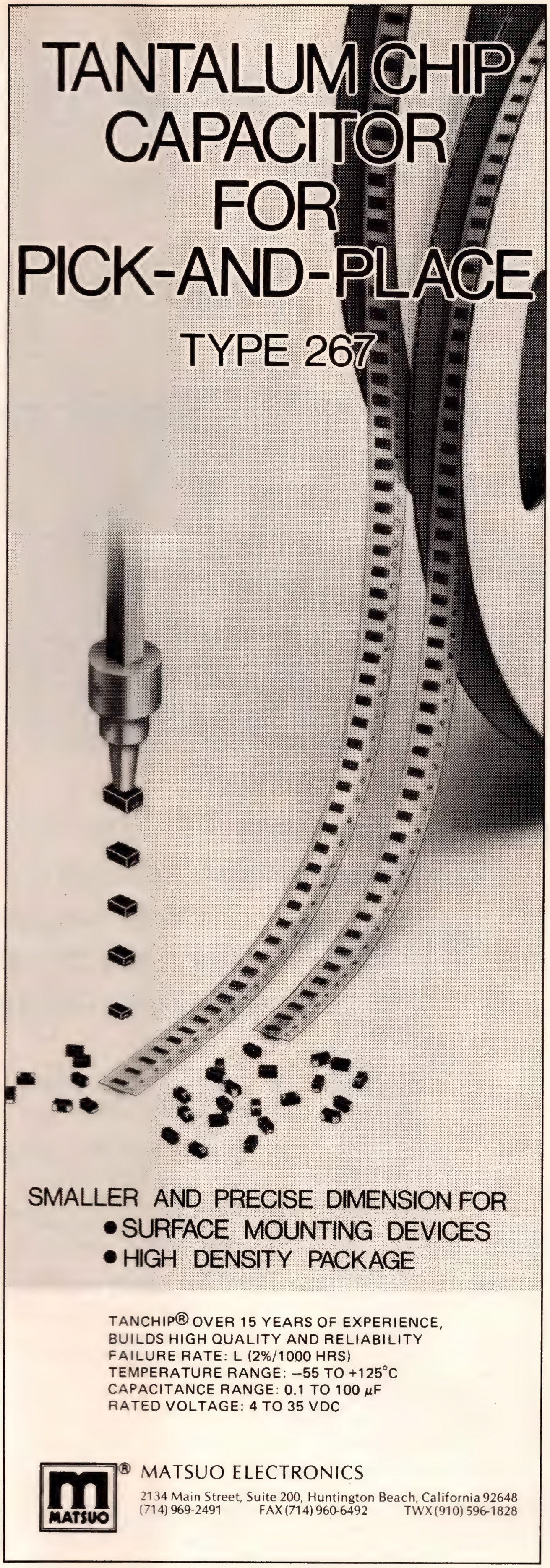
An output-programming pin selects between straight- or complementary-binary outputs, which are all TTL and CMOS compatible. Power requirements for the units are ±15 and ±5V, and maximum power dissipation is 1.5W. The 0 to 70°C version of the ADC-505, $346 (100). Delivery, stock to eight weeks.

Datel, 11 Cabot Blvd, Mansfield, MA 02048. Phone (617) 339-9341. TWX 710-346-1953.

Circle No 547

DISPLAY MODULE

The APD-240M026A-1 module displays 240 5×7 dot-matrix characters as six rows of 40 characters each. The plasma-display panel's characters are each 0.26 in. high×0.14 in.



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TYPE 267

SMALLER AND PRECISE DIMENSION FOR
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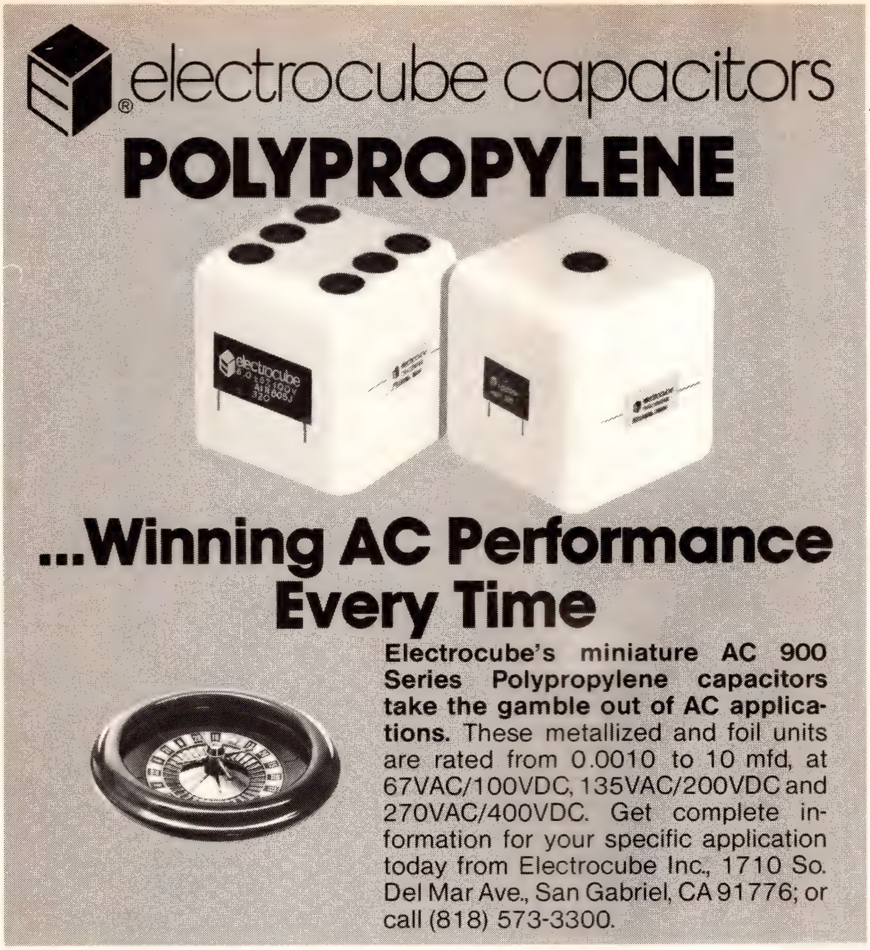
(714) 969-2491 FAX (714) 960-6492 TWX (910) 596-1828

CIRCLE NO 142



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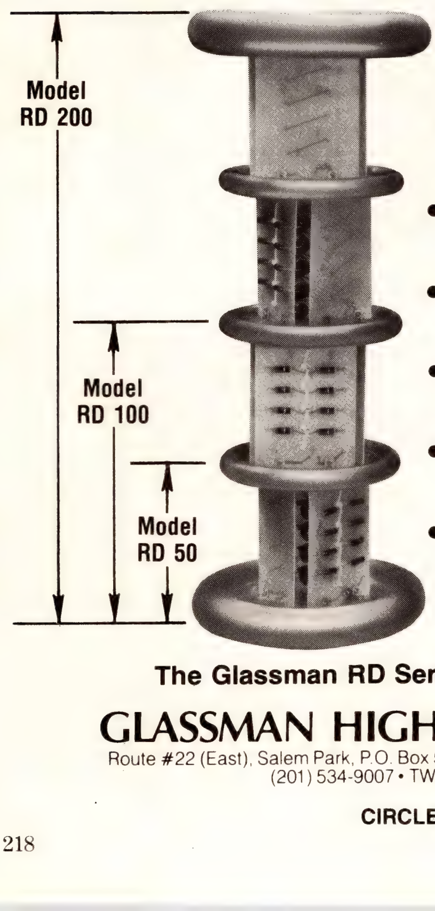
Electrocube's miniature AC 900 Series Polypropylene capacitors take the gamble out of AC applications. These metallized and foil units are rated from 0.0010 to 10 mfd, at 67VAC/100VDC, 135VAC/200VDC and 270VAC/400VDC. Get complete information for your specific application today from Electrocube Inc., 1710 So. Del Mar Ave., San Gabriel, CA 91776; or call (818) 573-3300.

CIRCLE NO 143



NEW precision instrument for voltage measurement of high voltage D-C power supplies that also measures A-C ripple component

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- Measurements accurate to 0.25% of full scale
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The Glassman RD Series

GLASSMAN HIGH VOLTAGE INC.
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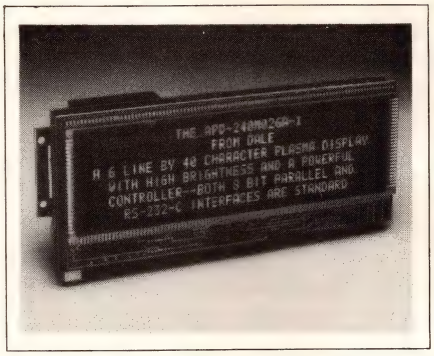
CIRCLE NO 144

Components


THE APD-240M026A-1
FROM DALE
A 6 LINE BY 40 CHARACTER PLASMA DISPLAY
WITH HIGH BRIGHTNESS AND A POWERFUL
CONTROLLER--BOTH 8 BIT PARALLEL AND
RS-232-C INTERFACES ARE STANDARD

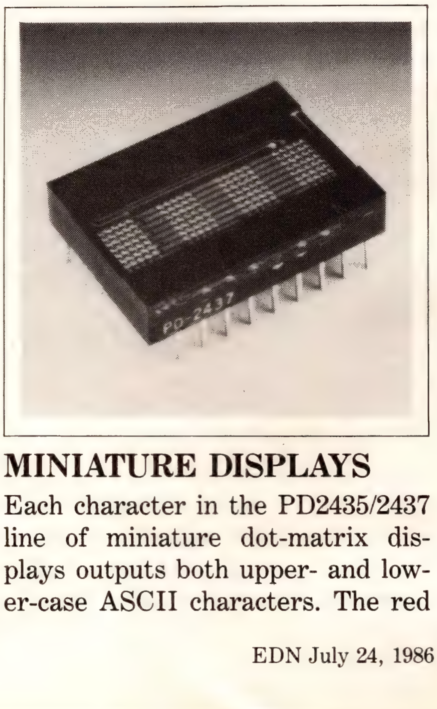
wide. The unit features a 100-fL brightness and a 150° viewing angle.

A μP-based controller accepts either 1- or 2-byte commands that simplify code generation and let you scroll the display and insert lines or individual characters. You can program the display for parallel or serial I/O modes. Besides the standard ASCII character set, the module's character-storage ROM lets you store a set of 128 user-defined characters for special-purpose displays.

Each module includes a dc-to-dc converter that powers the plasma display from a 12V dc input voltage. Modules measure 10.22×4.3×1.91 in. $705 (100). Delivery, 12 weeks ARO.

Dale Electronics Inc, 2064 12th Ave, Columbus, NE 68601. Phone (402) 564-3131.

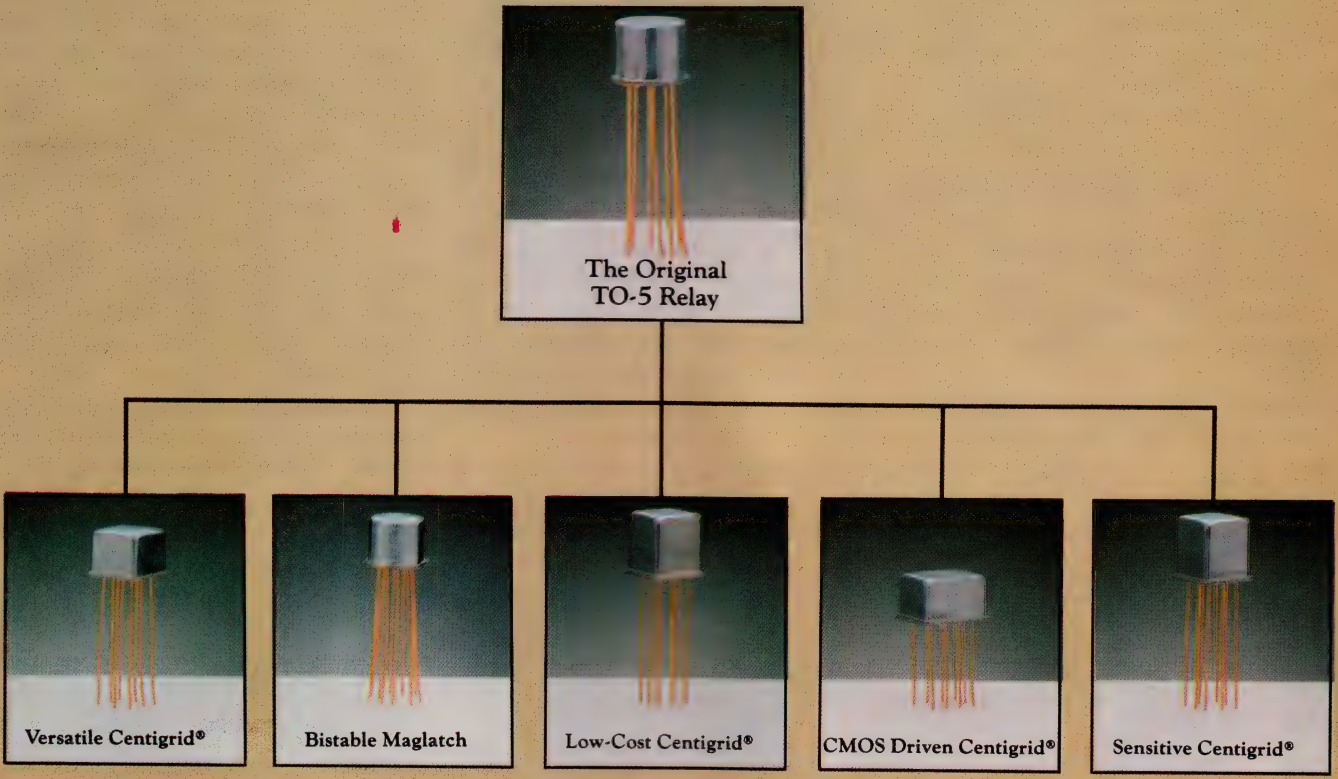
Circle No 549



MINIATURE DISPLAYS

Each character in the PD2435/2437 line of miniature dot-matrix displays outputs both upper- and lower-case ASCII characters. The red

From the industry's first choice come the industry's first choices.



We designed the original TO-5 relay over 20 years ago. But that was just the beginning. Since those first days, we nudged it into fathering a family of adaptations and extensions along the way.

In the process we also pioneered many innovative techniques for production, for manufacturing, and for quality control to ensure a reliability level so consistently high it would be taken for granted.

Of course, for us it never was.

Soon, TO-5 relays were available in latching versions, in single, double and 4-pole styles, and in hybrid versions with internal diode and transistor drive. All with excellent RF switching characteristics.

Today, there's a version for just about any application—general purpose and sensitive, commercial, and military (qualified to "L," "M" and "P" levels of MIL-R-39016).

Our family boasts the Centigrid® possibly the most advanced hermetically sealed armature relay available today. The Maglatch, a relay with memory and low power requirements. And lots of brothers and sisters to handle applications like high temperature, high shock, and high vibration designs for critical, hi-rel applications. We even have versions that can be driven directly from CMOS and TTL (qualified to "L" and "M" levels of MIL-R-28776).

If you'd like complete technical information on our TO-5 relay and all its offspring, or some applications help, or just a little history, drop a note or give us a call.

Like proud parents, we love to talk about the family.

TELEDYNE RELAYS
Innovations In Switching Technology

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Belgium Sales Office: 181 Chaussee de la Hulpe, 1170 Brussels • (2) 673-99-88
U.K. Sales Office: Heathrow House, Bath Rd., Cranford, Hounslow, Middlesex, TW 5 9QQ • 01-897-2501
Japan Sales Office: Taikoh No. 3 Building, 2-10-7 Shibuya, Shibuya-Ku, Tokyo, 150 Japan • (03) 797-5255

CIRCLE NO 145

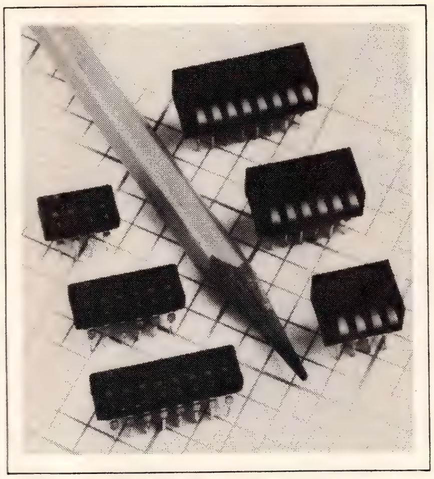
(PD2435) and green (PD2437) modules provide a ±50° viewing angle, and the packages let you stack the modules end-to-end to form a continuous line of characters.

The modules operate on commands and data sent to them on an 8-bit bidirectional data bus, which is TTL compatible. The commands govern the display's three brightness levels, as well as its character-blanking and character-blinking operations. The module includes the bus-interface control circuits, display-driver circuits, and the character ROM.

The modules operate with a 5V supply and require 200 mA (max) when all four characters are on. PD2435, $19.35; PD2437, $21.30 (1000).

Siemens Components Inc, Optoelectronics Div, 1900 Homestead Rd, Cupertino, CA 95014. Phone (408) 257-7910.

Circle No 550



DIP SWITCHES

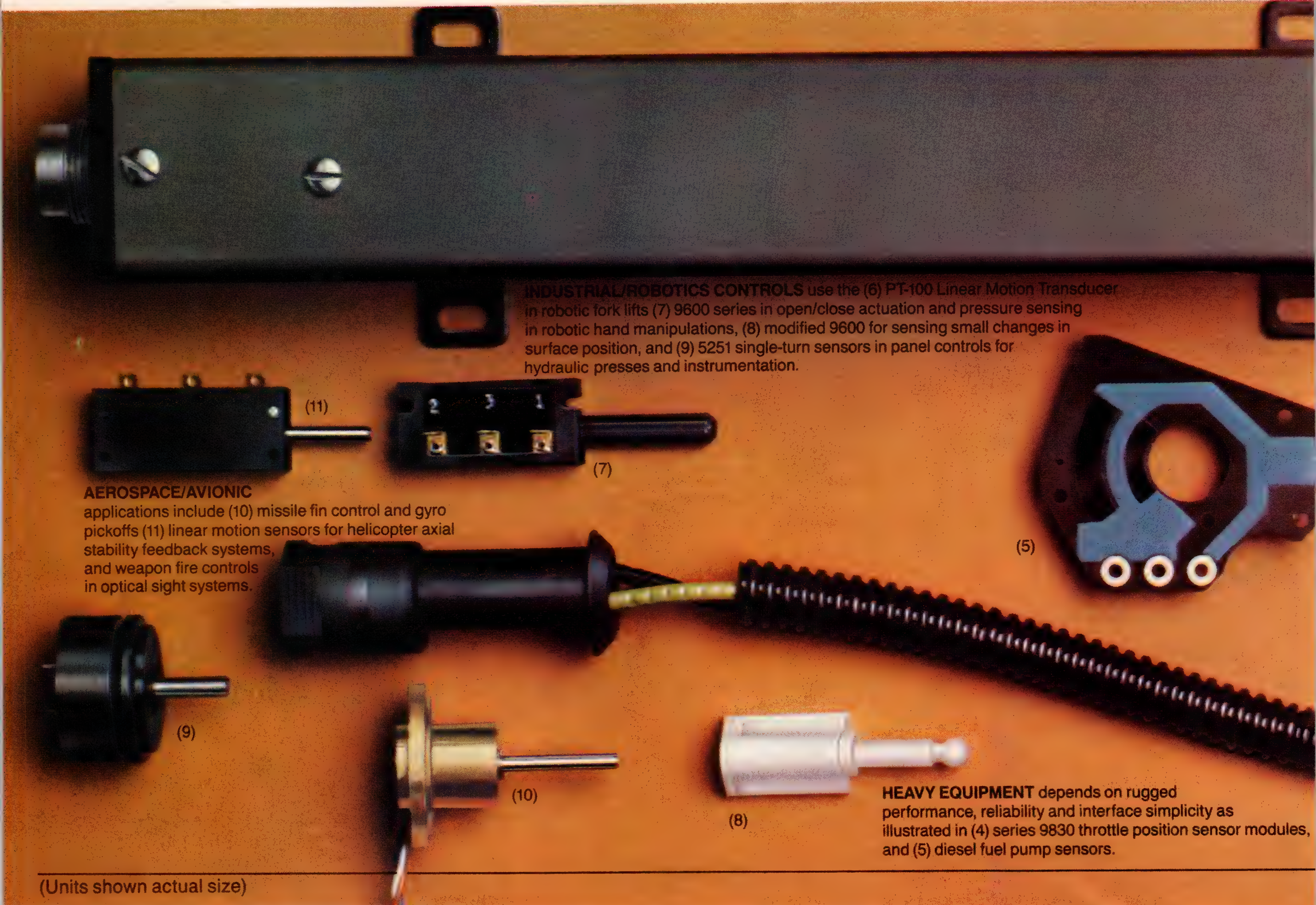
The A6D line of DIP switches provides internal seals that eliminate the need for taping before you solder and clean the switches. The internal seals protect the switches against solder flux, solder, cleaning solvents, and water.

The A6D top-actuated switches are available in 2- to 10-position versions, which you can load in magazines for automatic pc-board insertion. The A6DR side-actuated switches come in 4-, 6-, or 8-position versions. They comprise an actuator assembly that covers a set of top-actuated switches. The side-actuated switches project 0.29 in. above the board.

All switches feature self-cleaning switch contacts that handle from 100 mA at 5V dc to 30 mA at 30V dc. Their minimum permissible load is 10 mA at 3.5V dc. The switch contacts are nickel-plated beryllium copper with selective gold plating. The manufacturer rates the contacts' service life at 5000 mechanical operations. The switches' dielectric material withstands 500V dc for 1 minute. Four-position switches, $1.02 (1000).

Omron Electronics Inc, 1 E Commerce Dr, Schaumburg, IL 60195. Phone (312) 843-7900. TLX 910-291-0426.

Circle No 554

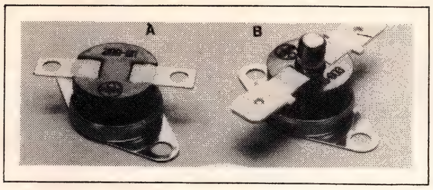


INDUSTRIAL/ROBOTICS CONTROLS use the (6) PT-100 Linear Motion Transducer in robotic fork lifts (7) 9600 series in open/close actuation and pressure sensing in robotic hand manipulations, (8) modified 9600 for sensing small changes in surface position, and (9) 5251 single-turn sensors in panel controls for hydraulic presses and instrumentation.

AEROSPACE/AVIONIC applications include (10) missile fin control and gyro pickoffs (11) linear motion sensors for helicopter axial stability feedback systems, and weapon fire controls in optical sight systems.

HEAVY EQUIPMENT depends on rugged performance, reliability and interface simplicity as illustrated in (4) series 9830 throttle position sensor modules, and (5) diesel fuel pump sensors.

(Units shown actual size)



THERMOSTATS

This series of precision miniature industrial and appliance thermostats features 1-piece, unitized contact construction. The unitized contact format results in high reliability and resistance to all forms of mechanical shock and vibration. Typical applications include test equipment, appliances, and consumer electronic equipment that is moved frequently.

In the Model 602 and 603 thermostats, a temperature-sensitive snap-action disk actuates make-break contacts at a predetermined temperature. By reducing the temperature of the Model 602 thermostat by 15 to 30°F, you cause the disk and contacts to return to their normal states. The Model 603 thermostat pops up a reset button when it reaches its temperature limit. The thermostat remains set until you press the button, restoring it to its normal state.

The manufacturer offers contacts in either an NO or an NC configuration. Contacts are normally silver, but gold contacts are available as an option if you need extremely low contact resistance. $3.75 (1000).

Selco Products Co, 7580 Stage Rd, Buena Park, CA 90621. Phone (800) 257-3526; in CA, (213) 921-0681. TLX 655457.

Circle No 553

PRESSURE SWITCHES

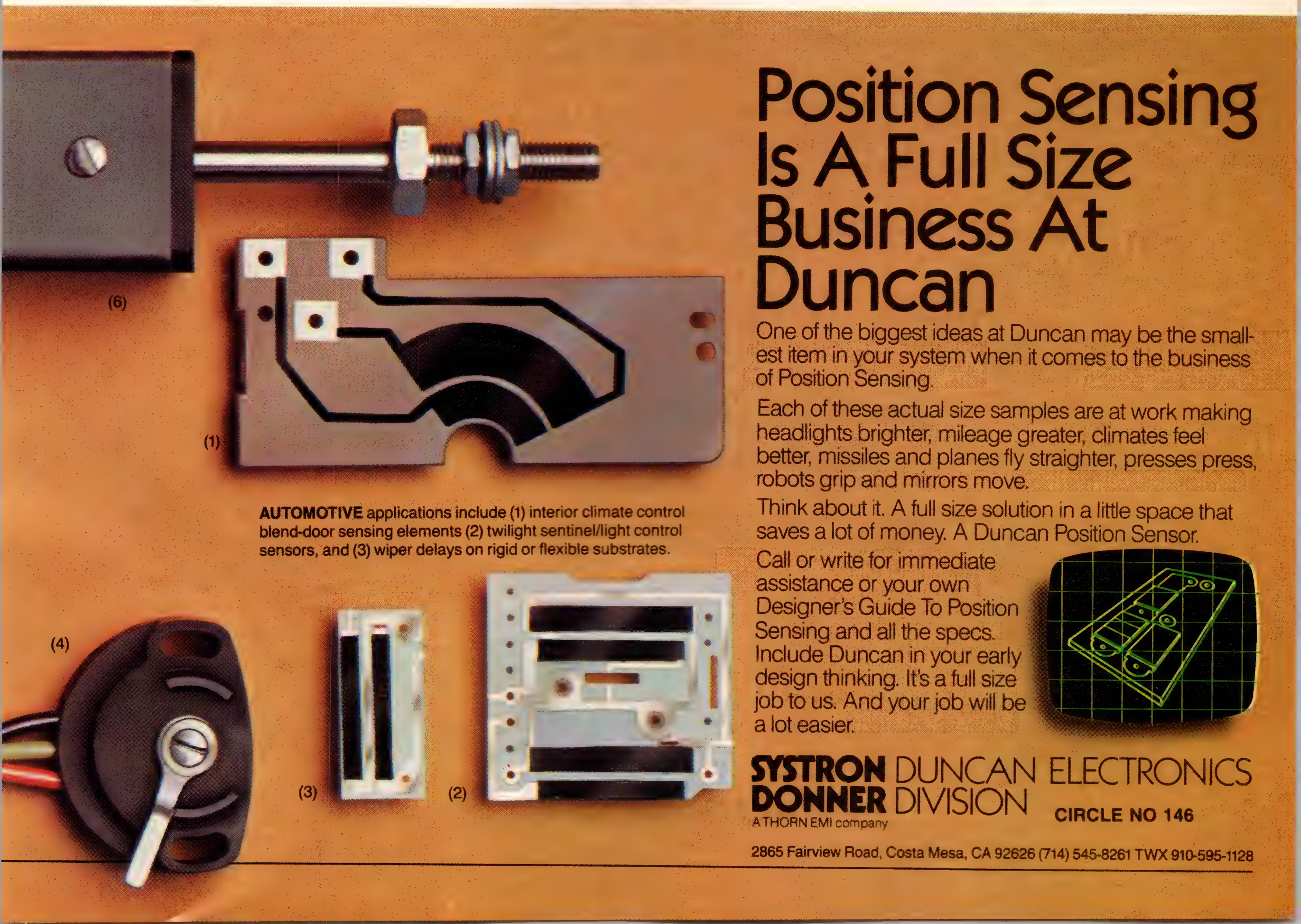
Suitable for sensing both positive and negative pressures, the 890-0010-Series pressure switches use a sealed metal bellows sensor that isn't subject to temperature sensitivity. Neither is the bellows sensitive to sticking and wear often found in sliding-piston-type pressure sensors.

An external screw lets you adjust the switch's set-point pressure with a repeatability of 1% FS over a pressure range from 0 to 90 psi. The sensor furnishes a 10 to 32 NF male-thread port that you can adapt to ⅛-in. standard pipe.

The sensor's internal snap-action switch carries 5A at 115V ac or at 28V dc. A 0.1-in. connector permits jumper or plug connections to other circuits. $46.

Robitech Inc, 10 Upton Dr, Wilmington, MA 01887. Phone (617) 657-6143.

Circle No 555



Position Sensing Is A Full Size Business At Duncan

One of the biggest ideas at Duncan may be the smallest item in your system when it comes to the business of Position Sensing.

Each of these actual size samples are at work making headlights brighter, mileage greater, climates feel better, missiles and planes fly straighter, presses press, robots grip and mirrors move.

Think about it. A full size solution in a little space that saves a lot of money. A Duncan Position Sensor.

Call or write for immediate assistance or your own Designer's Guide To Position Sensing and all the specs. Include Duncan in your early design thinking. It's a full size job to us. And your job will be a lot easier.

AUTOMOTIVE applications include (1) interior climate control blend-door sensing elements (2) twilight sentinel/light control sensors, and (3) wiper delays on rigid or flexible substrates.

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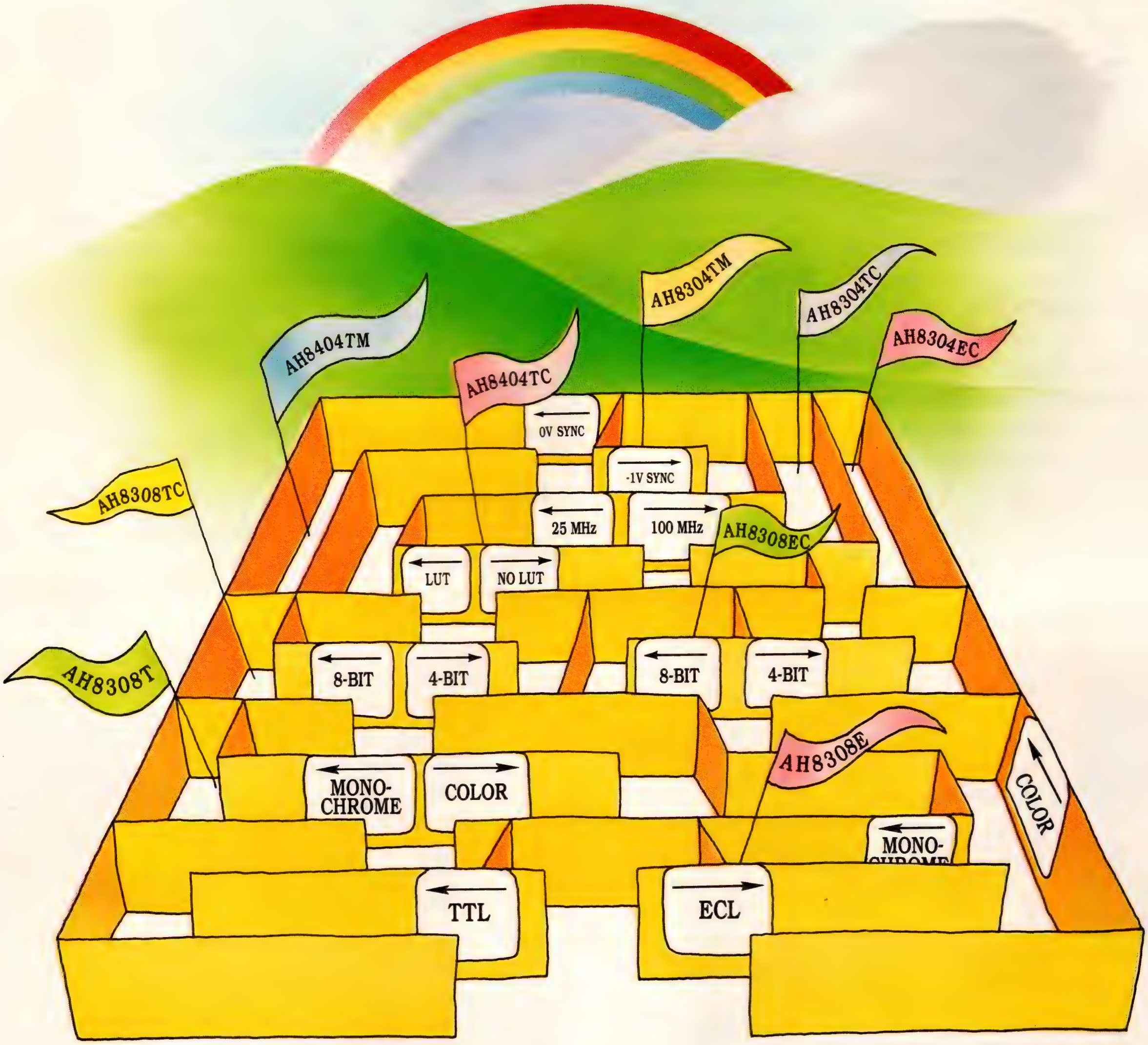
CIRCLE NO 146

2865 Fairview Road, Costa Mesa, CA 92626 (714) 545-8261 TWX 910-595-1128

Analogic Makes It Easy To Find The Right VDAC.



You'll Find the Features You Need in an AH8000 Series Hybrid Video DAC.

The choice is yours. Monochrome or tri-color. Four-bit or eight. Direct ECL- or TTL-coupling. Even on-board look-up tables, if you want them.

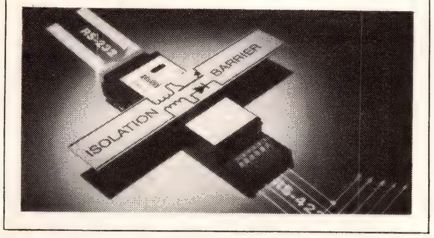
Of course, they all include the Analogic-introduced features that have become industry standards, like glitch-free output that can be connected directly to a 75-ohm monitor and integral sync and blanking controls. These cool-running, meticulously engineered chips deliver the reliable, no-trade-off performance our customers have come to expect from all Analogic products.

Take the AH8308EC. This ECL-compatible hybrid combines three 8-bit video DACs in a single, 40-pin DIP dissipating only 2.0W. Its RS343/330-compatible video output is updated at 150 MHz, making it ideal for high-resolution applications in color graphics, CAD/CAM, medical imaging, and image processing.

If you're looking for a hybrid video DAC, send for our VDAC Lit Pack. It's the best place to start. Just circle the reader service number, or call Dick Cummings at (617) 246-0300 X2115 for an immediate response.

ANALOGIC®

CIRCLE NO 147



CONVERTER MODEMS

Modems in the LDM422 Series are compact RS-232C-to-RS-422 converters that feature an electrical isolation barrier and heavy-duty electrical-surge protectors. Housed in rugged aluminum enclosures, the modems are small enough to mount on the back panel of most computer equipment. Optical couplers and a dc/dc converter provide isolation.

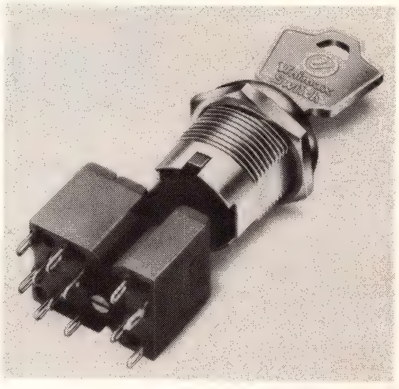
The family is designed for full-duplex operation over two wire pairs plus a ground return. The 3-state outputs permit multidropping of as many as 32 units. Hardware handshake is available over two additional wire pairs. You can use the second pair as a second full-duplex data channel. One unit may serve as a 2-channel RS-232C/RS-422 converter.

Data rates are 75 to 19,200 baud. Six diagnostic LED indicators are provided for installation guidance and system troubleshooting. The RS-232C interface supports Request to Send, Clear To Send, Data Set Ready, Received Line Signal Detect, and Data Terminal Ready. The RS-422 interface supports Request To Send and Clear to Send on separate wire pairs. From $111.

Burr-Brown Corp, Box 11400, Tucson, AZ 85734. Phone (602) 746-1111. TWX 910-952-1111.

Circle No 558

KEYLOCK SWITCHES

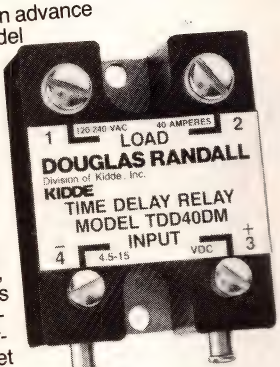


The CT Series' separate switch elements and keylocks allow you to preassemble the switch element to its wire leads and the keylock to the panel. At final assembly, the prewired switches slide onto the premounted keylock. The switch elements provide gold-plated, double-break, double-throw contacts rated at 5A/250V ac. Available in single- and double-pole configurations, the UL- and CSA-recognized switch elements allow you to assemble a keylock switch with as many as four poles.

Discrete contacts facilitate the switching of different voltages for different circuits. Switches are

NOW! SOLID-STATE
TIME DELAY
Switching up to
40 Amps!

Douglas Randall introduces an advance in solid-state switching: The Model TD time delay relay. With DC or AC inputs, it is available in both 25 and 40 amp ratings at 120/240 VAC. This new relay series offers adjustable delayed make or delayed break time delay and retains all of the other desirable characteristics of dependable solid-state switching including opto-isolation, zero crossover, and integral heat sink. Delay is accurately controlled by a timing resistor across the "R" terminals with nominal values set at 16K ohms per second. Write us today for complete specifications and prices.



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CIRCLE NO 150

Servometer Flexible
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The three R's of positioning performance. And Measurement Systems' proportional joysticks are letter-perfect.

They're rapid. The high speed comes from their ease and naturalness of operation, which also gives you higher accuracy in positioning and tracking. There is continuous output for infinite resolution, with no dead zone.

They're rugged. Even in the trackless wastes, they keep on tracking. Flawlessly.

They're reliable. Mean time between failures is 200,000 hours. And they'll run for 10,000,000 cycles, minimum.

That's why these joysticks are specified for such a variety of applications — computer graphics, visual displays, fire control systems, hoists, vehicle control and robots, to name a few. They'd probably fit your specifications as well. To the letter.

For more information, call or write us.

Actual Size Shown

MS Measurement Systems, Inc.
121 Water Street, Norwalk, CT 06854, U.S.A. (203) 838-5561

CIRCLE NO 148

Compare!

Signal's LP 40-300 $8.97*
Prem's SPW 306 $8.35

Isn't it time you compared PC power transformers? Ask for a Prem quote today on your part number to see how much your savings will be. Your competitors are.

†FREE Catalog with cross references.

*Both prices 10-24 quantities. Source: Signal Transformer Oct. 1, 1985 price list. Prices subject to change without notice.

†For immediate technical data, see Vol. 1 1985/86 EEM or Vol. 2 1985/86 Goldbook

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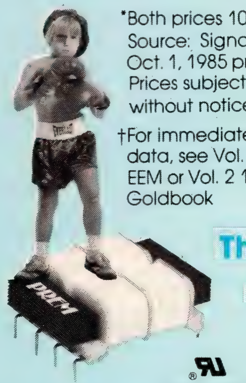


available in solder, quick-connect, and wire-wrapped styles. Mating keylocks are available in 2- and 3-position models with a variety of maintained and momentary key-position arrangements.

Each keylock features a 5-disk tumbler-lock mechanism, which offers as many as 100 different key-codes. Key pulls in all maintained key positions are standard; other key-pull options are available. $7.30 to $12 (1000).

Unimax Switch Corp, Ives Rd, Wallingford, CT 06492. Phone (203) 269-8701.

Circle No 557

LAN DRIVER

The HYC9058 high-impedance transceiver module includes the drive circuitry, as well as the transmitter and receiver filters that provide interference-free transfers over local-area networks (LANs). The module offers a very high impedance output that minimizes line loading and lets several nodes use the same wire in a network to provide a bus topology. Media aren't restricted to RG-62 coax.

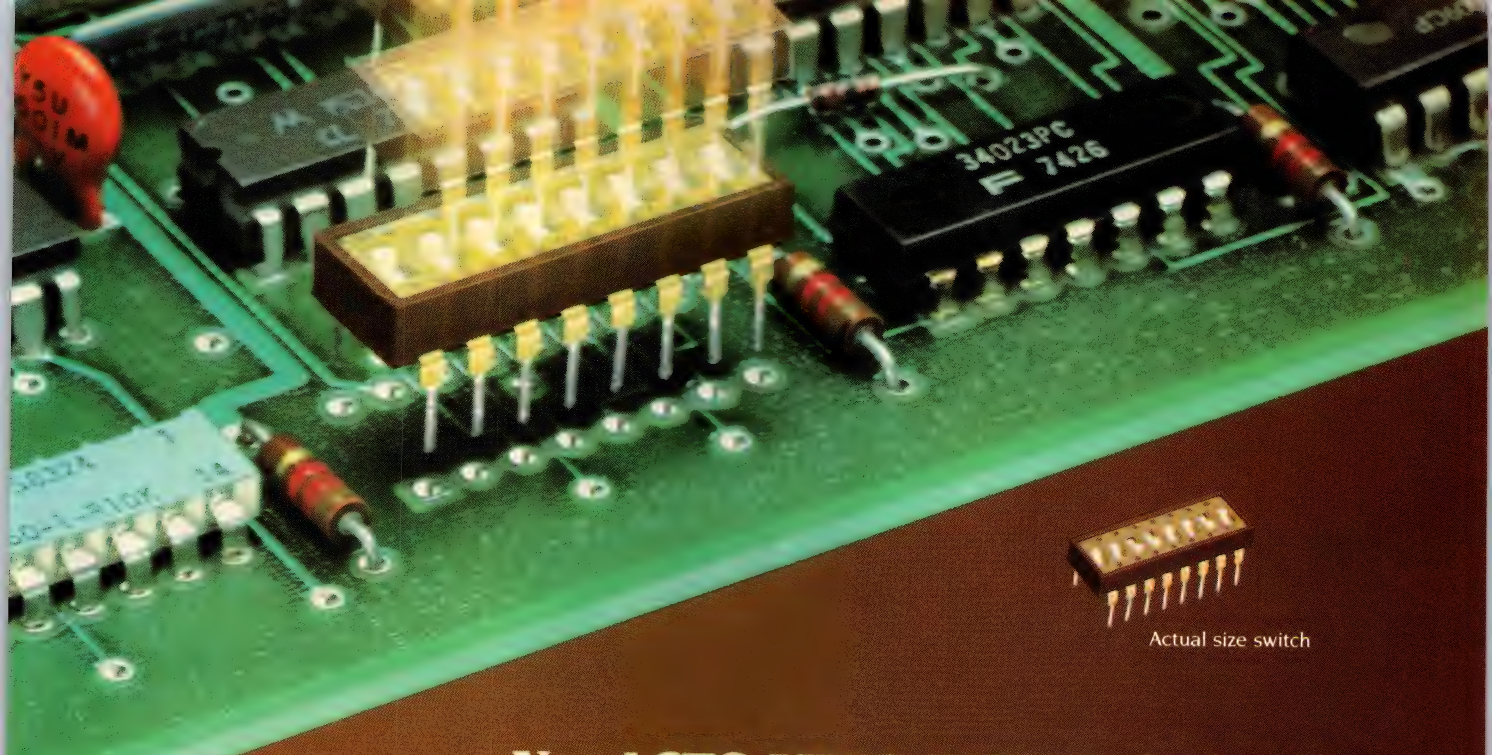
For small networks that contain eight or fewer nodes and extend over distances of 1000 ft or less, the module eliminates the need for an active or passive hub. You wire all network nodes to a single line. The manufacturer furnishes the module in a 20-pin SIP with either straight leads or leads bent at 90°. $32.35 (100). Samples are available now; production quantities are available in six to eight weeks.

Standard Microsystems Corp, 35 Marcus Blvd, Hauppauge, NY 11788. Phone (516) 273-3100. TWX 510-227-8898.

Circle No 556

ROTARY SWITCHES

MRS Series miniature rotary switches are available with shaft knob or key actuation and feature as many as three poles and 12 posi-


Actual size switch

New! CTS AUTO-DIP™ Switches for
AUTOMATIC INSERTION!

You'll realize immediate cost savings in board production with the New CTS Series 207 AUTO-DIP™ Switch.

Because they are the same size as your IC's—these new Series 207 AUTO-DIP™ switches can be used in your automatic insertion equipment right along with IC's...without machine adjustment. You get economical high speed board production. You'll save significant board space as well! This new switch takes only 37% of the volume of a standard DIP switch allowing for closer board stacking and space savings.

Wave solderable! Board washable! The AUTO-DIP™ design eliminates bottom sealing. And, a lead frame housing construction with time-proven tape top seal keeps contaminants out of the switch through wave soldering and solvent or aqueous cleaning.

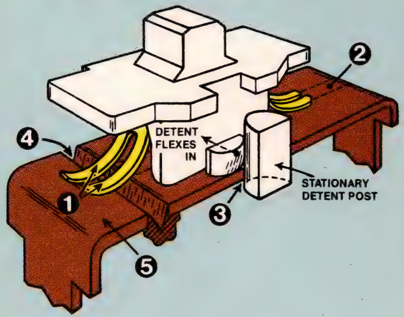
Reliability you can count on. During the fully automated assembly process, each Series 207 DIP Switch is 100% machine tested for continuity and contact resistance. In addition, statistical process control used in every step during manufacturing assures unvarying part quality and final reliability. Available in 2-position to 12-position switches.

WRITE TODAY for full technical data on these new Series 207 AUTO-DIP™ switches.
Contact: CTS Corporation,*
Paso Robles Division,
Electromechanical Group,
500 Linne Road,
Paso Robles, CA 93446.
Phone: (805) 239-0427

*In Calif. dba CTS Electronics Corporation

CIRCLE NO. 10

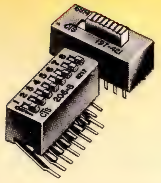
Switch reliability that is the best ever!



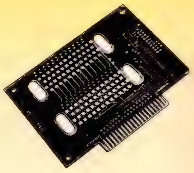
1. Redundant gold inlaid contacts dramatically enhance contact reliability.
2. Positive wiping contacts assure low and consistent contact resistance. (.050" travel)
3. Detent function separated from contacts to optimize both designs.
4. Gold contacts never abraded or contaminated by sliding over polymer surfaces. Contacts never touch a nongold surface
5. No contactor deflection for the life of the switch. Constant contact force eliminates overstressing of contacts for greater reliability.

CTS means Reliability

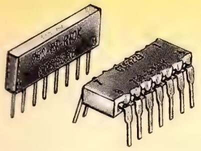
CTS CORPORATION • ELKHART, INDIANA



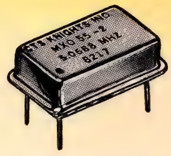
Series 206RA & 197 Right angle and 4PDT slide actuated DIP switches.
Phone: (805) 238-0350
CIRCLE NO. 49



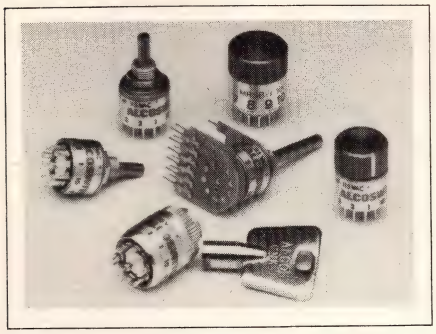
PC Boards Complex double-sided and multilayer.
Phone: (415) 659-1770
CIRCLE NO. 88



Series 750 & 760 Solid ceramic SIP and DIP resistor networks.
Phone: (219) 589-8220
CIRCLE NO. 127



Series MX055 Low profile hybrid clock oscillators.
Phone: (815) 786-8411
CIRCLE NO. 166



tions. All models have either fixed or adjustable stops. You can order straight or right-angle versions with either lug-type or printed-circuit terminals and gold or silver contacts.

The switches have splash-proof, environmentally sealed bodies. The life expectancy of the switch exceeds 10,000 cycles; contacts are rated for 150 mA at 115V ac. PC-mount, 1-pole, 10-position version, $5.47 (100).

Alco Electronic Products Inc, 1551 Osgood St, North Andover, MA 01845. Phone (617) 685-4371. TWX 710-342-0552.

Circle No 559

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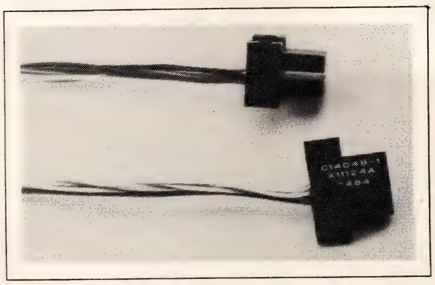
CIRCLE NO 152



OPTICAL SWITCHES

The 112 Series universal optical switches have integral mounting brackets and wire leads for side mounting as far as 24 in. from associated circuit boards. Internal hybrid thick-film circuitry provides amplification and wave shaping.

An internal LED current-limiting resistor protects the light source. The devices require a 5V dc power input and provide Schmitt trigger outputs capable of driving 10 TTL gates. Single- and dual-channel versions are available in 0.062-, 0.125-, and 0.188-in. gap sizes. Standard sensor aperture width is 0.015 in. Single-channel version, $5.21; dual-channel version, $7.40 (1000). Delivery, 60 days ARO.

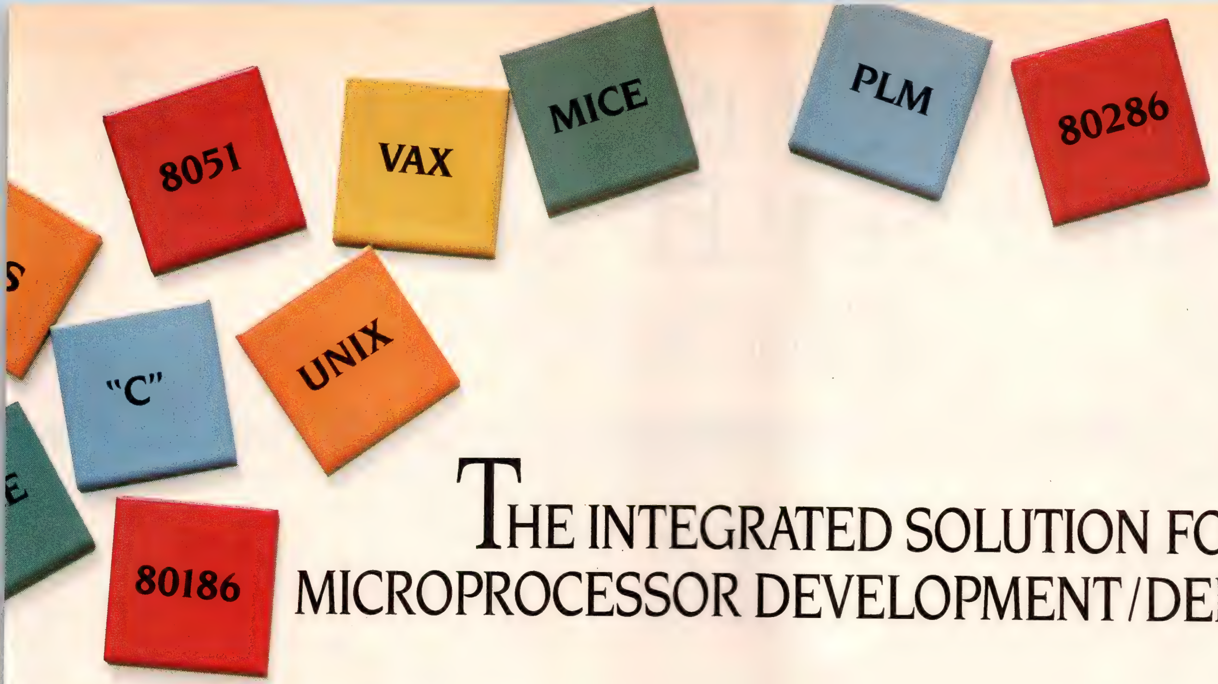
HEI Inc, Light Sensing Products Div, Box 5000, Victoria, MN 55386. Phone (612) 443-2500.

Circle No 560

TRANSFORMERS

Low-profile, split-bobbin transformers in 24- and 48-VA ratings have been added to the company's Flathead Series. The devices include rugged, square-wire, plug-in pins to handle the weight and amperage. Height above the pc board is 1.25 and 1.375 in. for the 24- and 48-VA units, respectively.

Secondary output ratings for the



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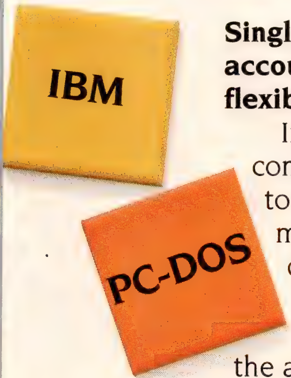

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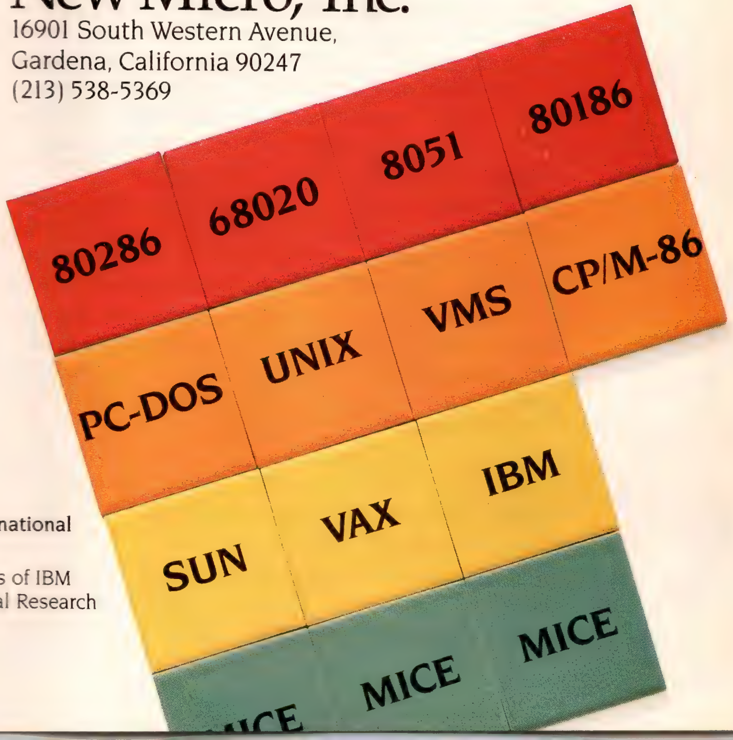

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*New Micro, Inc. is the exclusive U.S. distributor for Microtek International in-circuit emulators.

NOTE: PC-DOS, MS-DOS, VAX/VMS, UNIX, CP/M-86 are trademarks of IBM Corporation, Microsoft Corp., Digital Equipment Corp., AT&T, Digital Research Inc., respectively.

CIRCLE NO 153

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EECO Limited, Trafalgar Way, Bar Hill,
Cambridge CB3 8SQ, England
Phone: Crafts Hill (0954) 80257, Telex 817303

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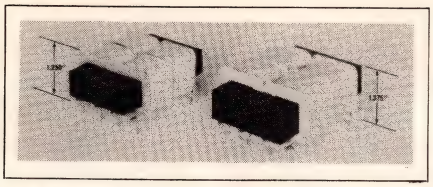
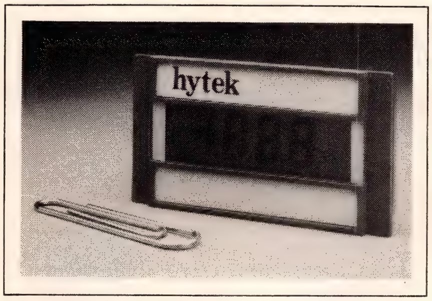
CIRCLE NO 157



24-VA size range from 10V center tap at 2.4A to 28V at 850 mA (series-connected); the 48-VA size ranges from 10V center tap at 4.8A to 56V at 425 mA (series-connected). 24-VA, \$7, 48-VA, \$9.

Signal Transformer Co, 500 Bayview Ave, Inwood, NY 11696. Phone (516) 239-5777.

Circle No 562



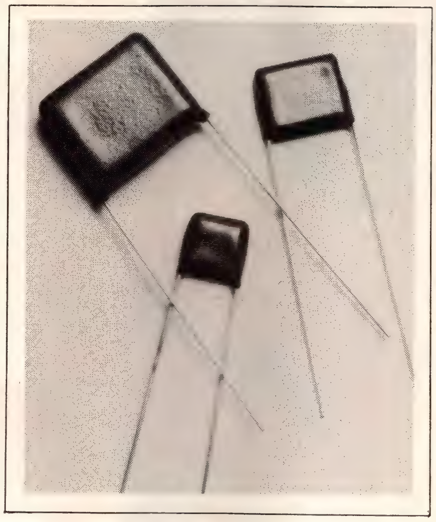
PANEL METER

The HY6300 is a 3.5-in. digital panel meter with 0.4-in.-high LCD digits and balanced differential analog inputs. It comes in a watertight compact package less than 0.5-in. deep and operates in harsh environments over 0 to 50°C.

The device contains a custom hybrid circuit that can measure voltages from 100 μV to 200V and currents from 100 nA to 2A. It measures resistance from 1Ω to 20 MΩ. The meter is powered by a 9V battery requiring 12 mW of power or a 5V supply. \$34.95.

Hytek Microsystems Inc, 980 University Ave, Los Gatos, CA 95030. Phone (408) 395-2300. TWX 910-597-5393.

Circle No 561

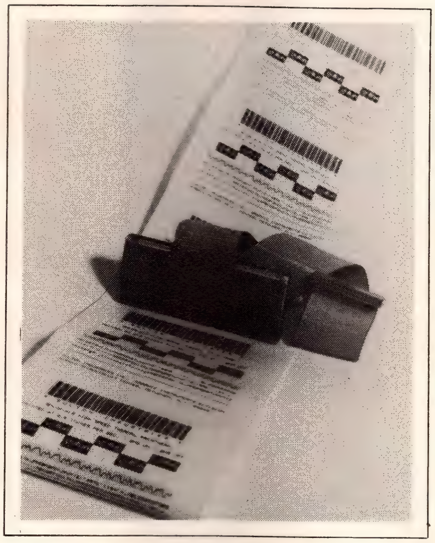


CERAMIC CAPACITORS

These high-voltage multilayer ceramic capacitors are fully tested for a corona level of less than 50 pC at the rated V_{rms} and less than 10 pC at 80% of the rated V_{rms}. This low corona level in the capacitor body increases the component's reliability, according to the manufacturer. Capacitors are available with values from 10 pF to 0.22 μF, with voltage ratings from 500 to 3500 V_{rms}. \$8 to \$30 (100).

KD Components, 3016 S Orange Ave, Santa Ana, CA 92707. Phone (714) 545-7108.

Circle No 563



THERMAL PRINTHEADS

Onboard electronics for the SM-Series of thermal printheads include double-latched printer inputs. Suitable for graphics applications, the devices print on a thermal roll or label stock, or print through thermal transfer ribbon onto plain paper.

Printing time is 4 msec per cycle

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☐ Also ask about our end-stackable LC6 and MC6 Series!

NEW! 2M Series
☐ .200" center-spacing, 2 through 24 positions
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*Patent Pending

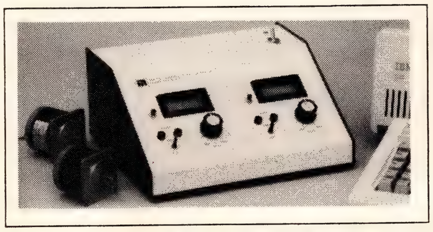
CIRCLE NO 156

(2 msec on; 2 msec off) for dot densities as high as 102 dots/in. and speeds as high as 4 ips. The dot line is along the substrate edge for early last-line visibility. Other features include thick-film construction, a factory-replaceable protective bar in front of the resistive printing element, and HVI²L 32-bit IC drivers.

Thermistor preheaters are optional. A minimum thermal life of 50×10⁶ dot lines is guaranteed. The units are ready to use with an integral heat sink and connector-terminated PVC cable. $160 to $400. Delivery, 90 days ARO.

Gulton Industries Inc, Graphic Instruments Div, Gulton Industrial Park, East Greenwich, RI 02818. Phone (201) 548-6500. TWX 710-387-1500.

Circle No 564



MOTOR CONTROLLER

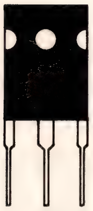
The SMC-202A provides computer or manual control of one or two stepping motors and comes in a sloped-front cabinet that includes all necessary power supplies, motor drives, and an RS-232C interface.

Both rack-mount and circuit-board versions are available. A µP controls motions, including acceleration and deceleration ramping, stored-program control, relative and absolute positioning, and automatic backlash compensation. The RS-232C port and an optional GPIB/IEEE-488 bus allow simplified interfacing to computers, controllers, and terminals.

Programming commands are single-letter mnemonic codes. Manual control features include a front-panel momentary toggle switch to run the motors, a front-panel speed control to adjust the stepping rate, and

COST CUTTERS

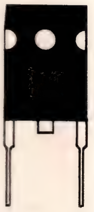
Unitrode Saves You Money, Time and Space with TO-247 Power UES and Schottkys



Now you can cut your switching power supply component cost by as much as 30% or more, and save assembly time and board space with Unitrode's ultra fast switching epitaxial rectifiers (UES) and Schottky families in the new TO-247 plastic power package. UES are available from 50V to 200V (16A–45A) and Schottkys are rated from 30V to 45V (16A–45A).

If you're used to working with DO-4 or TO-3 packages, you'll really appreciate the advantages of the TO-247. It's PC board mountable and spring clip compatible for mounting and heat sinking. V_f and I_r are extremely low and it has high current surge capability. Schottkys are guard ring protected for reverse transients and have a t_{rr} which is effectively 0. (For UES devices, the t_{rr} is <50ns.)

And if you're already using the TO-218 plastic package, you'll like the TO-247 package even better. It replaces the TO-218 with less hardware, and its extra advantages include an isolated mounting hole. You can also use a TO-247 instead of a TO-220, and eliminate the need for a heat sink.



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I want to see how great Unitrode's new TO-247 UES and Schottkys really are. Send me datasheets.

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Company Name: ______________________________
Address: ______________________________
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CIRCLE NO 158

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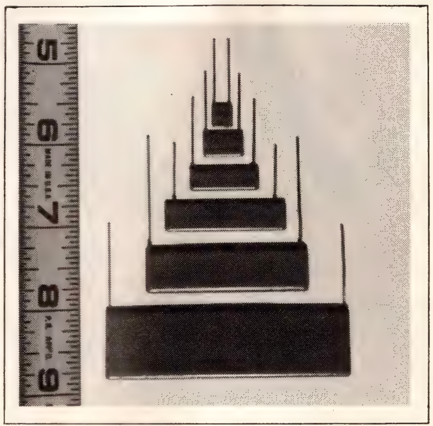
Maxwell Electronics Inc, Dept C, Box 12033, Research Triangle Park, NC 27709. Phone (919) 846-1633.

Circle No 569



THICK-FILM RESISTORS

The Slim-R Series thick-film resistors offer a 0.1-in. profile with voltage ratings as high as 30 kV and wattage ratings from 0.25 to 8W. These noninductive ruthenium resistors offer temperature coefficents from 50 to 250 ppm/°C over the −55 to +125°C operating range.

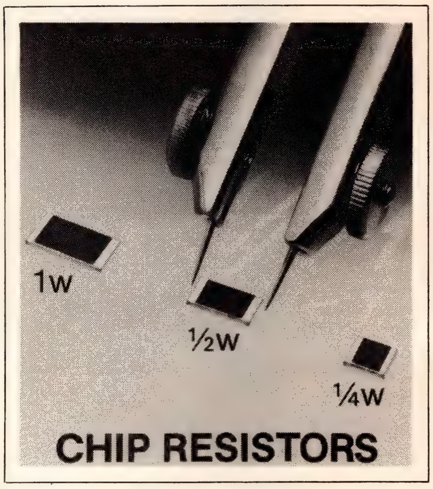
Resistance values to $10^9\Omega$ are available with tolerance values of 1, 2, 5, 10, and 20%. You can choose flame-retardant epoxy or glass-coated packages in six standard sizes; pc-board mounting doesn't require that you bend the leads. $0.17 to $0.84 (OEM qty).

Thickfilm International, Box 85-0, Indian Head, MD 20640. Phone (301) 375-8666. TWX 710-829-0590.

Circle No 565

CHIP RESISTORS

The MRC25, MRC50, and MRC100 surface-mount chip resistors spec 0.25, 0.5, and 1.0W power dissipation, respectively. Each type is offered with a 1 or 5% tolerance and with a ±100- or ±200-ppm/°C temperature coefficient (measured at 70°C).



The resistor's operating range is −40 to +125°C. Resistance ranges are 100 to 160 kΩ (MRC25); 100 to 80 kΩ (MRC50); and 100 to 40 kΩ (MRC100). As a design convenience, a 0Ω jumper chip is available for each of the three styles. Chip dimensions (with ±0.2-mm tolerance) are 3.2×2.6 mm (MRC25); 5.0×2.5 mm (MCR50); and 6.3×3.15 mm (MCR100).

Resistors are bulk-packaged for shipment in 200-piece quantities. The MRC25, $0.10; the MTC50, $0.15; the MRC100, $0.25 (200). Delivery, six to eight weeks ARO.

Rohm Corp, Box 19515, Irvine, CA 92713. Phone (714) 855-2131. TWX 910-595-1721.

Circle No 566

SOLID-STATE RELAYS

These miniature panel-mount solid-state relays come with screw terminals (MSSR Series) or push-on tab-type terminals (TSSR Series). Both series are optoisolated and offer synchronous, zero-voltage switching.

Inputs are TTL/CMOS compatible, and high-voltage triac outputs with built-in RC snubbers are standard. Load ratings at 120/240V ac are 3 or 12A (MSSR Series), and 3, 12, or 30A (TSSR Series).

In both series, the maximum digital-input current can be specified as

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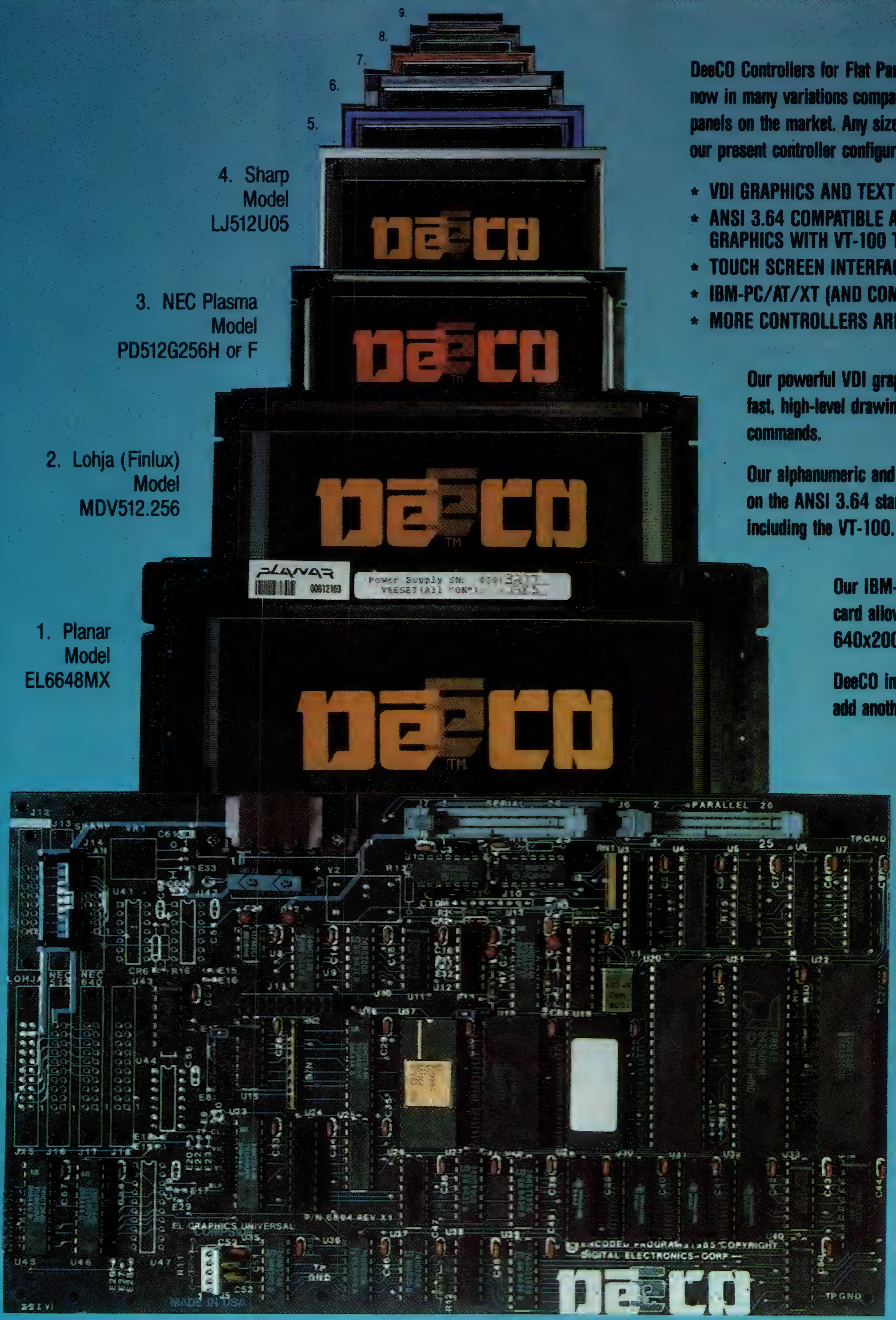

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TWX 910-498-2701

CIRCLE NO 160

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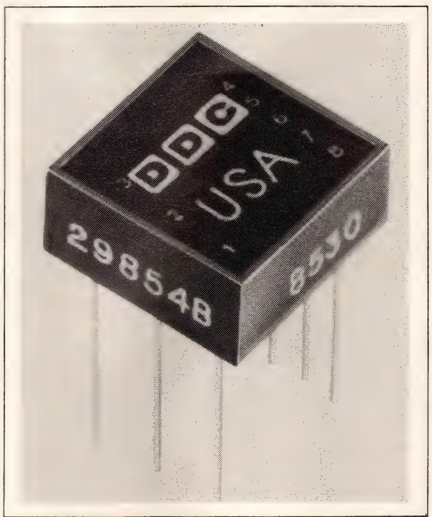
Antex Electronics Corp, 16100 S Figueroa St, Gardena, CA 90248. Phone (213) 532-3092. TWX 910-344-7381.

Circle No 567



TRANSFORMER

You can use the BUS-29854 transformer with a MIL-STD-1553 serial MUX data bus. This pulse transformer provides all of the turns ratio, component isolation, and common-mode rejection characteristics required of Manchester II serial 2-phase data transmission. It has a turns ratio of 1:0.83 and 1:0.60; operating range is −55 to +125°C.

The transformer rises 0.275 in. above the circuit board. It's packaged in accordance with MIL-T-21038 and is compatible with the manufacturer's BUS-63107 Series data-bus transceivers. The tin-coated steel leads accommodate pc-board mounting. The device processes sinusoidal or trapezoidal waveforms in accordance with MIL-STD-1553. $35. Delivery, eight weeks ARO.

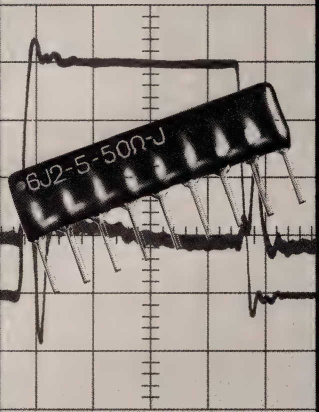
ILC Data Device Corp, 105 Wilbur Pl, Bohemia, NY 11716. Phone (516) 567-5600. TWX 510-228-7324.

Circle No 571

25 mV/V

at 100 pS Rise Time

LOW NOISE TERMINATION RC NETWORKS



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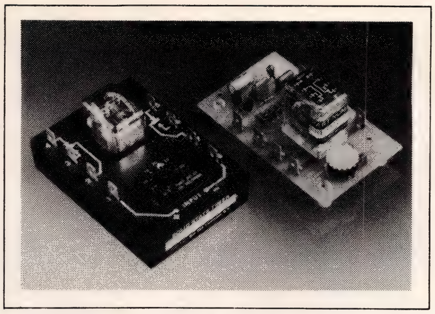
CIRCLE NO 161



TIME-DELAY RELAYS

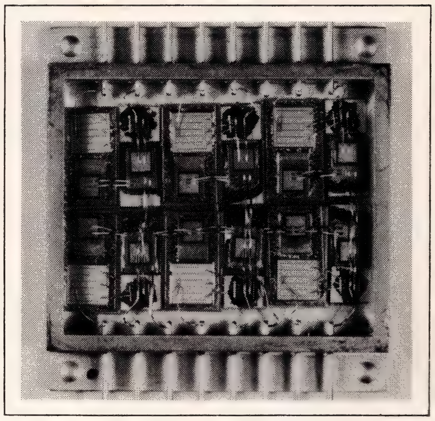
The ERD and OR Series time-delay relays are designed to eliminate the need for hand wiring during board assembly. The ERD Series features digital timing circuits and plastic housings. The dpdt output has a 10A rating.

You can order the relays with remote adjustment, onboard adjustment (knob and dial), or with a fixed delay. Time delay ranges from 100 msec to 15 minutes, and repeat accuracy specs at ±0.5%. These devices are available in delay-on-make, interval, and single-shot versions. The OR Series units feature an open board construction and use an analog timing circuit.

The output relay (spdt or dpdt) has a 10A rating. Delays range from 50 msec to 5 minutes, and repeat accuracy specs at ±2%. ERD Series, $15.64 (500); OR Series, $12.83.

SSAC Inc, Box 395, Liverpool, NY 13088. Phone (315) 622-1000.

Circle No 568



SPEED CONTROLLERS

The design of these motor controllers allows you to resolve complex wiring problems. The half bridges, single-phase full bridges, and 3-phase full bridges incorporate power MOSFETs or transistor chips, flyback diodes, and additional circuitry; the interconnects are enclosed in copper packages.

The components are electrically isolated from the controller package, so you attach it directly to a heat sink. Power ratings for the half bridges, single-phase and 3-phase full bridges are 500V/13A, 400V/15A, 200V/30A, and 100V/40A. Special circuit configurations are available upon request. $200. Delivery, 12 to 16 weeks ARO.

Solitron Devices Inc, Sales Dept, 1177 Blue Heron Blvd, Riviera Beach, FL 33404. Phone (305) 848-4311. TWX 510-952-7610.

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*For more information please contact:

DC DENSITRON CORPORATION OF AMERICA

E-M DIVISION P.O. BOX 1318, 1015 MILL ST. CAMDEN, SOUTH CAROLINA 29020 U.S.A.
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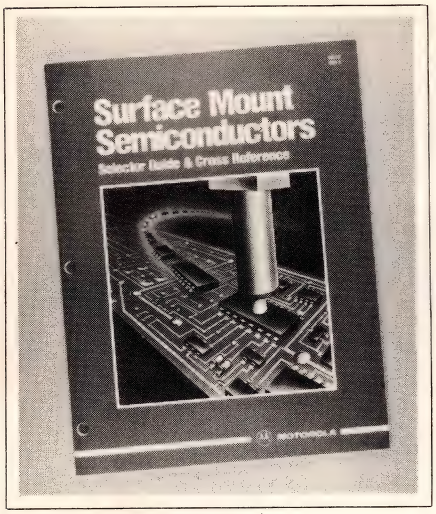
GE-118


Surface Mount Semiconductors
Selector Guide & Cross Reference
MOTOROLA

Selector guide lists surface-mount devices

The devices found in the *Surface Mount Selector Guide and Cross Reference (Catalog BR127)* range from simple small-signal transistors to complex µPs and peripheral devices. The guide also lists surface-mount power transistors, diodes, logic devices, linear circuits, and military ICs. It provides packaging dimensions, geometries, thermal characteristics, and tape-and-reel specifications for automatic-placement equipment.

Motorola Inc, Literature Distribution Center, 616 W 24th St, Tempe, AZ 85282.

Circle No 401

MOS data book contained on floppy disk

The *MOSpower Computer Data Book* contains the information normally found in the vendor's MOSpower data book but it comes on a 5¼-in. floppy disk for use with IBM PC and PC-compatible computers. You can access data on components by specifying either the part number you want or the characteristics of the part you need (if you don't know the part number). You can specify breakdown voltage, power dissipation, drain-source current, and on-resistance. The program also contains information about new products, sales offices, and disk-copying procedures. It prints out a customer request form that you can send to the company.

Siliconix Inc, Box 4777, Santa Clara, CA 95054.

Circle No 402

DMOS design-contest winners presented

Featuring the winning entries from a double-diffused MOS (DMOS) design contest conducted by the manufacturer, this 60-pg booklet describes a variety of p-channel DMOS products. It includes DMOS applications articles and information on data-sheet interpretation. The publication also contains a cross-reference and product-selection guide.

Supertex Inc, Customer Service Dept, Box 3607, Sunnyvale, CA 94088.

Circle No 403

Military ICs characterized

The 480-pg *Military Products Databook* contains specifications for the manufacturer's monolithic and hybrid ICs that comply with MIL-STD-883C, Rev C. It covers such products as A/D and D/A converters, op amps, and both analog and digital signal-processing components. The book provides general and detailed specs, as well as a MIL-M-38510 cross reference, a product-selection guide, a glossary, package specs, and model-number index.

Analog Devices, 70 Shawmut Rd, Canton, MA 02021.

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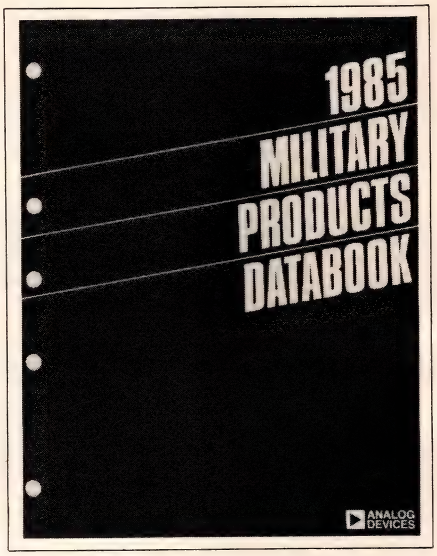

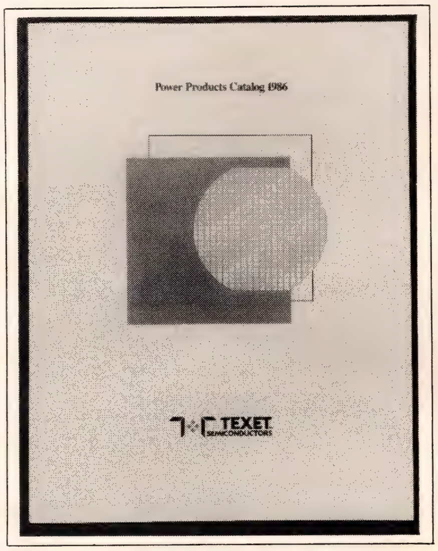

Power MOSFETs, regulators listed in catalog

The *Power Products Catalog 1986* provides descriptions of more than 300 power MOSFETs and linear voltage-regulator ICs. Both proprietary and industry-standard products are represented. The 12-page catalog details MOSFETs with breakdown voltages ranging from 20 to 500V and continuous-current ratings as high as 50A, and it lists the choice of packages for the MOSFETs. The linear voltage-regulator ICs described include two

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	Density	Org.	Access Time (ns)	Mode	Packaging
DRAMs					
KM4164	64K		120/150	PAGE	DIP
KM41256	256K		120/150	NIBBLE	DIP, PLCC, ZIP
KM41257	256K		120/150	NIBBLE	DIP, PLCC, ZIP
EEPROMs					
KM2816A	16K	2K x 8	300/350	R/B	DIP
KM2817A	16K	2K x 8	300/350		DIP
KM2864A*	64K	8K x 8	250/300		DIP, PLCC
SRAMs					
KM6264*	64K	8K x 8	100/120/150		DIP/SOP

*Qual samples available Q2. Production quantities in Q3.

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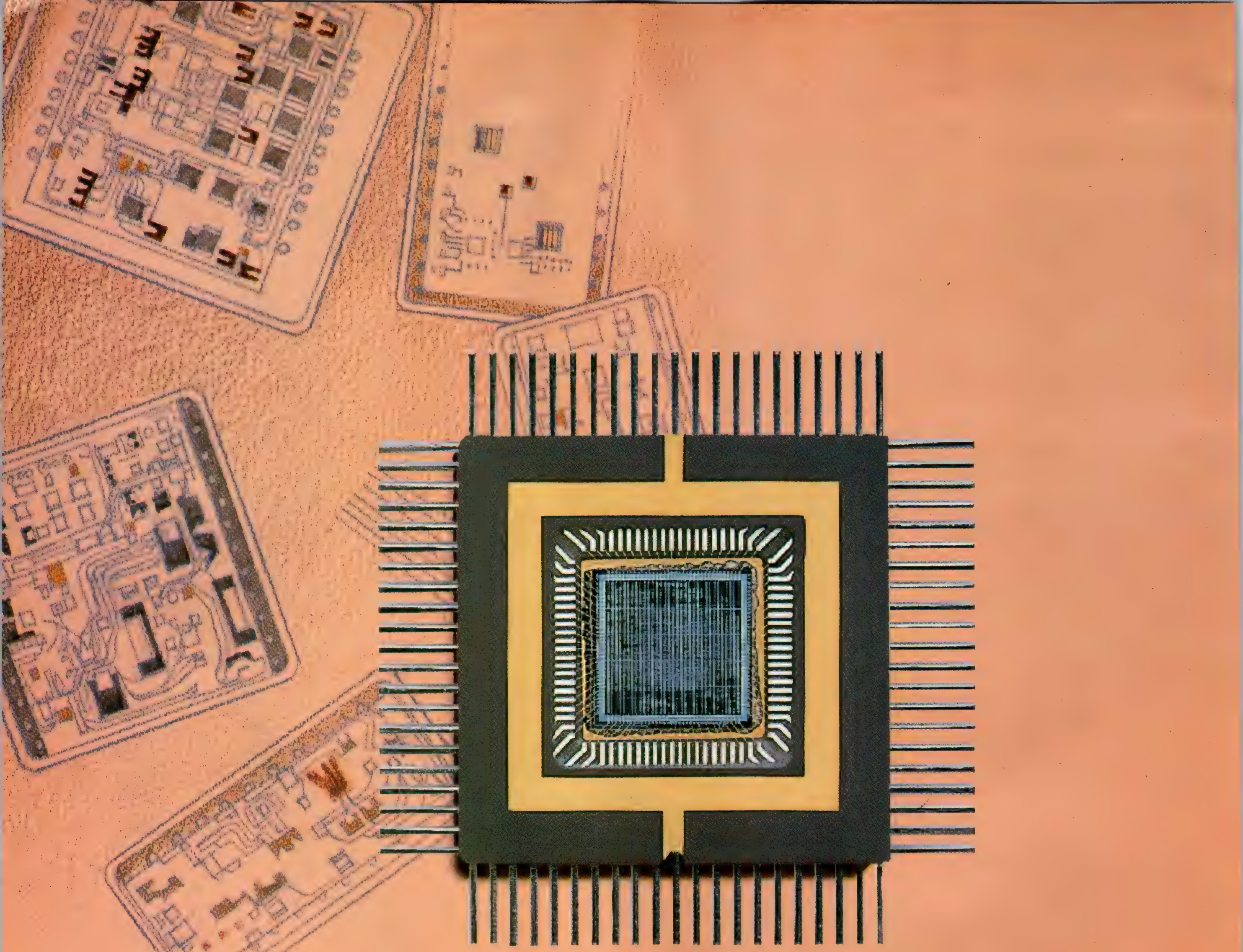

A compact 1553 that carries a busload.

The UT1553B BCRT data bus system proves that big things do come in small packages. It's loaded with features including both MIL-STD-1553B Bus Controller and Remote Terminal functions and advanced, specialized memory management—all on one low-power CMOS chip.

It's the next generation product in our 1553 family. The BCRT was designed to reduce host intervention with automatic DMA and address generation. It automatically executes message transfers, provides interrupts, and generates status information. UTMC's BCRT allows you to implement a pseudo-transparent dual-port RAM configuration.

The BCRT's bus controller uses a linked-list message scheme to provide the host with message "chaining." Memory space is optimized by using programmable address pointers. As an RT, the BCRT implements time tagging and message history functions. It also supports multiple-message buffering—up to 128—including variable-length messages to any subaddress.

The BCRT complies with the standard LAN used for military systems while meeting selected tests in MIL-STD-883C. It is available in 84-pin LCCs, PGAs, or Cerquads.

Don't miss the bus on your 1553 system needs. Call UTMC.

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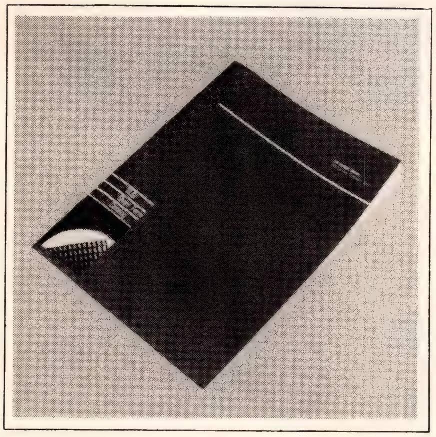
proprietary families and standard LM323 and LM340 devices. Also included in the catalog are power MOSFET dice that meet MIL-STD-750D, Method 2072 standards for visual inspection.

Texet Semiconductors, 301 Texet Dr, Allen, TX 75002.

Circle No 406



Converters, DSP chips categorized

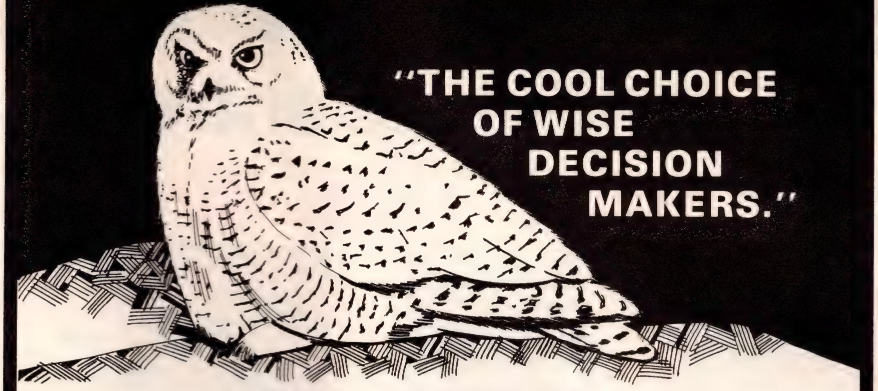
This 8-pg short-form catalog describes a line of VLSI high-performance converters and digital-signal-processing components; both CMOS and bipolar parts are included. The products are organized in six categories: A/D converters, D/A converters, multipliers, multiplier/accumulators, memory/storage products, and special-function products.

TRW, LSI Products Div, Box 2472, La Jolla, CA 92038.

Circle No 407

Guide lists design hints for op-amp circuits

Entitled *The DOs and DONT's of High Speed Op Amps,* this 2-pg guide contains 12 recommendations for designers working with high-speed op amps. A brief explanation follows each recommendation; for more complete explanations, the guide directs you to the manufacturer's data sheets and applications notes. The sheet covers pc-board layout, heat sinks, feedback, oscilla-



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☐ Completely "video-ready"
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*MWPS (Megawords Per Second) is the digital update rate.

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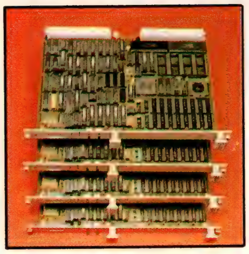
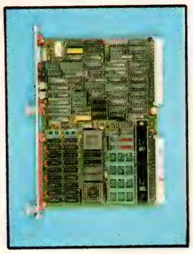
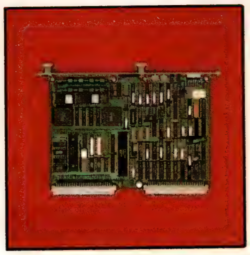


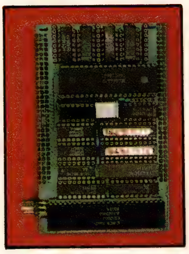
CPU-2RT



CPU-2SC



CPU-2PB

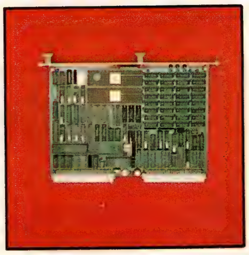


PIGGY BACK
BOARDS

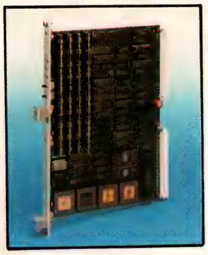
68020
@ 12.5 MHz,
16.5 MHz, or
20 MHz,
DRAM ¼ Mb,
1 Mb, or 4 Mb

CPU-4RT

STAND ALONE HOST



CPU-1



CPU-3

	STAND ALONE HOST		REAL-TIME MASTER/SLAVE			
	CPU-1	CPU-3	CPU-2RT	CPU-2SC	CPU-2PB	CPU-4RT
MICROPROCESSOR	68000/68010	68010	68000/68010	68000/68010	68000/68010	68020
FREQUENCY	8MHz	12.5 MHz	12.5 MHz	12.5 MHz	12.5 MHz	12.5 - 20 MHz
MEMORY MANAGEMENT	68451	68451 (2nd as option)				
DMA	LOGIC		68450 option	68450 option	68450 option	
FLOATING POINT PROCESSOR		68881 (option)			68881 (option)	68881 (option)
RAM (DUAL PORTED)	256 Kb	2 Mb	128/512 Kb	128/512 Kb	512 Kb	1/4, 1, 4 Mb
EPROM		2 Sockets (128 Kb)	2 Sockets (128 Kb)	2 Sockets (128 Kb)	2 Sockets (128 Kb)	2 Sockets (128 Kb)
EEPROM			2 Sockets (16 Kb)	2 Sockets (16 Kb)		
SIO	1 PORT	1 PORT	2 PORTS	4 PORTS	•I/O ON PIGGYBACK BOARDS •PB-SCSI1 SCSI/DMA •PROTO BD	3 PORTS
PIO	1 PORT		1 PORT			
TIMERS	1	4/ 8 bit	3/ 16 bit			1/ 32 bit
ADDITIONAL FEATURES	1K PROM FLOPPY DISK CONTROLLER	Translation Cache	R/T CLOCK 58274	R/T CLOCK 58274		
SOFTWARE	UNIX* SYS V	UNIX* SYS V pSOS**	pSOS** PDOS***	pSOS**	pSOS**	pSOS** PDOS***

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tion, and appropriate voltage and signal levels for op-amp circuits.

Comlinear Corp, 4800 Wheaton Dr, Fort Collins, CO 80525.

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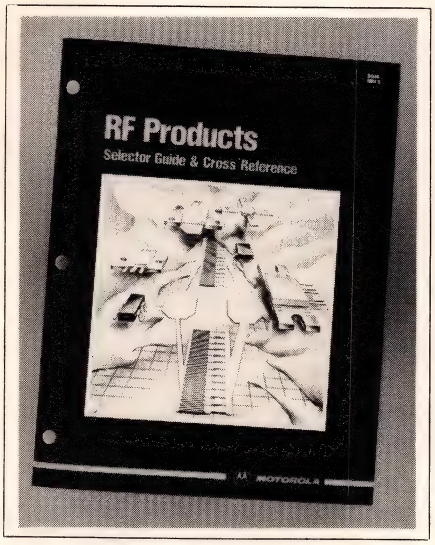

RF devices, circuit hints compose selector guide

The *RF Selector Guide and Cross Reference* describes the manufacturer's portfolio of radio-frequency (RF) devices. Three types of transistors are included: RF power TMOS FETs, RF power bipolar transistors, and RF small-signal transistors. In addition, the guide lists hybrid amplifiers that are suitable for RF circuits. It also includes a section of recommended RF products that you could select to achieve desired output-power levels for your application.

Motorola Inc, Literature Distribution Center, 616 W 24th St, Tempe, AZ 85282.

Circle No 409

Catalog covers MOS ICs

Data sheets for more than 100 of the manufacturer's communications, memory, µP/µC, and consumer products comprise one section of *The 1985 MOS Products Catalog.* Another section focuses on the custom services that the company offers in the silicon-foundry, CAD/CAE-support, and gate-array and standard-cell areas. The catalog also lists more than 200 arrays and cells and provides information on development costs. In addition, it describes the company's methods for working with users of its application-specific ICs.

Gould AMI Semiconductors, Literature Dept, 3800 Homestead Rd, Santa Clara, CA 95051.

Circle No 408

Data book includes industrial, military ICs

The 343-pg *FET Data Book* includes 41 industrial and military FETs not found in the vendor's previous data book, bringing the total number of FETs described in this literature to 350. The book provides 107 pages of applications notes in addition to specifications and performance data for the devices. Eight new applications notes show such FET applications as amplifiers, current protectors, contant-current sources, and analog switches. A new section highlights applications where you can use FETs as alternatives to traditional circuits, such as op-amp front ends and diodes.

Siliconix Inc, Box 4777, Santa Clara, CA 95054.

Circle No 410

Erasable-PLD handbook covers devices, applications

The *EPLD Handbook* is a 248-pg reference manual for logic design-

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Settling Time	10 ns to .2%	12 ns to .4%
Slew Rate	300 v/µs Min.	300 v/µs typ.
Conversion Rate	200 MWPS*	100 MWPS*
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*MWPS (Megawords Per Second) is the digital update rate.

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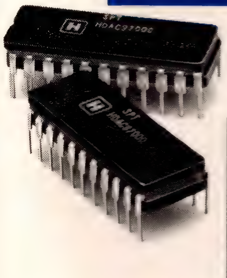
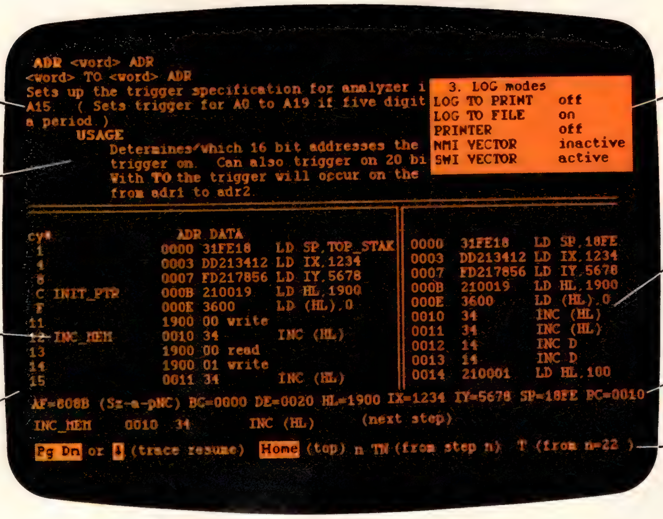


Microprocessor Development Dreams Come True!



On-Line Help menus, Command Glossary, and Word List.

Windows can be used to view source files, previous traces, and more.

Symbol translation or source code line display.

Screen displays scroll off into history buffer – can be viewed later.

Pop-up Mode Selection panel called by soft key.

Disassembly of code in memory can be compared with trace in adjacent window.

Symbolic debug register display.

Context sensitive prompt line.

```
ADR <word> ADR
<word> TO <word> ADR
Sets up the trigger specification for analyzer i   3. LOG modes
A15  ( Sets trigger for A0 to A19 if five digit  LOG TO PRINT    off
a period )                                        LOG TO FILE     on
     USAGE                                        PRINTER         off
        Determines which 16 bit addresses the     NMI VECTOR      inactive
        trigger on.  Can also trigger on 20 bi    SWI VECTOR      active
        With TO the trigger will occur on the
        from adr1 to adr2

cy#                ADR DATA                       0000  31FE18    LD SP,18FE
 1                 0000 31FE18   LD SP,TOP_STAK   0003  DD213412  LD IX,1234
 4                 0003 DD213412 LD IX,1234       0007  FD217856  LD IY,5678
 8                 0007 FD217856 LD IY,5678       000B  210019    LD HL,1900
 C INIT_PTR        000B 210019   LD HL,1900       000E  3600      LD (HL),0
 F                 000E 3600     LD (HL),0        0010  34        INC (HL)
11                 1900 00 write                  0011  34        INC (HL)
12 INC_MEM         0010 34        INC (HL)        0012  14        INC D
13                 1900 00 read                   0013  14        INC D
14                 1900 01 write                  0014  210001    LD HL,100
15                 0011 34        INC (HL)
AF=808B (Sz-a-pNC) BC=0000 DE=0020 HL=1900 IX=1234 IY=5678 SP=18FE PC=0010
INC_MEM     0010  34        INC (HL)        (next step)
Pg Dn or ↓ (trace resume)  Home (top) n TN (from step n)  T (from n=22 )
```

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- **An Input Stimulus Generator**

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An Integrated Software Environment, too!

Imagine being able to split your screen and look at real-time program traces and the source code that produced them at the same time! Then go to the On-Line Help or pop-up Mode Panels instantly.

If you see something on a trace that doesn't look like last time, you can hold it in one window while you scroll back through your previous displays.

If you set a breakpoint and single-step, you can then go back to using the analyzer without missing a beat. You can even execute a DOS batch file from UniLab to edit, assemble, and link, then automatically load the new program and symbol table. UniLab uses the full power of the PC.

Find bugs fast with Hardware-assisted Debugging

The traditional way to look for bugs is to single-step through suspect parts of the code until you catch it in the act. This requires a lot of guessing and wasting time.

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UniLab lets you use commands or menus – or a mixture of both. An on-line manual, soft-key help screens, a glossary of commands and their parameters, with full-screen writeups are also at the ready.

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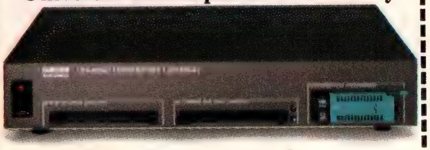
Universal Development Laboratory



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ORION

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In California (415) 361-8883

CIRCLE NO 180

ers. The book discusses technology choices, software, development-system support, and performance considerations. More than half of the book is devoted to applications information with explanations of design examples. Also included are data sheets for the manufacturer's EPLD product family. $7.95.

Altera Corp, 3525 Monroe St, Santa Clara, CA 95051.

INQUIRE DIRECT

Gate-array data book lists 140 macrocells

The *1985 Gate Array Databook*, intended for the designers of application-specific ICs (ASICs), contains data sheets for more than 140 of the vendor's single- and double-metal 3-μm macrocells. The book includes data sheets for schematic-capture aids, and it incorporates a gate-array design guide, which describes the general specifications of the library and die architectures. Also covered are net-list generation, simulation, circuit design, testability, packaging, and assembly.

Gould AMI Semiconductors, Literature Dept, 3800 Homestead Rd, Santa Clara, CA 95051

Circle No 414

Catalog depicts nonvolatile memory chips

Covering nonvolatile memory products, this 464-pg data book describes the company's 17 series of EEPROMs, six series of serial I/O devices, 11 series of nonvolatile RAMs, and the E^2POT device. The book includes information on truth tables and read, write, and store cycles. It provides pin-configuration and functional diagrams and describes the functions of the pin terminals. The book also contains sections on applications, reliability, and packaging.

Xicor Inc, 851 Buckeye Ct, Milpitas, CA 95035.

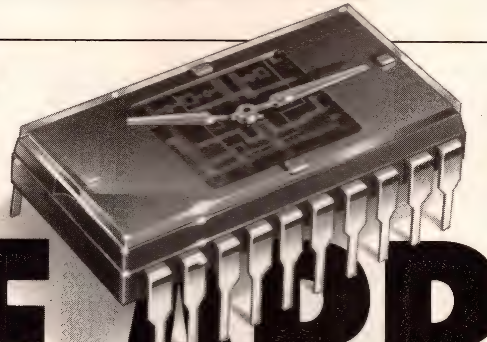
Circle No 411

Guide to surface-mount chips

Surface Mounting Integrated Circuits is a document that lists the manufacturer's surface-mount devices by part number, package type, and function. Among the devices covered are TTL low-power Schottky, CMOS 4000, high-speed CMOS, and linear ICs, as well as application-specific ICs and μCs. The brochure also provides general information on surface-mount technology, such as cost and quality compared with standard DIPs.

SGS Semiconductor Corp, 1000 E Bell Rd, Phoenix, AZ 85022.

Circle No 412



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CIRCLE NO 173

Guide to SCSI interconnections

This 6-pg fold-out brochure gives a brief listing of the company's interconnection products for the SCSI Bus, illustrating typical SCSI network interconnections as defined by ANSI X3T9.3 standards. The brochure cross references individual photos of the connectors, cables, cable assemblies, headers, sockets, and terminators to an illustration of an interconnection, and it identifies interconnections that meet ANSI, ECMA, and ISO standards for SCSI network applications.

Amphenol Products, 4300 Commerce Ct, Lisle, IL 60532.

Circle No 424

Chart gives material specs

This slide chart features material specifications for pc boards. The chart offers at-a-glance information on physical, mechanical, electrical, and thermal properties of different grades of materials from different manufacturers. Also covered are tooling concepts and the use of raw materials. Send a business card with your request.

Dynacircuits Inc, 11230 Addison St, Franklin Park, IL 60131.

INQUIRE DIRECT

Brochure features relays and sockets

This 8-pg brochure features the manufacturer's line of relays, including solid-state, mechanical plug-in, and miniature pc-mount types. The publication covers relays for horizontal and vertical pc-board or plug-in mounting, as well as snap-mount spade and octal-relay sockets. It lists the benefits of each type of relay and provides a relay-selection guide. Tables, graphs, and diagrams present technical data.

Electromatic Controls Corp, 2495 Pembroke Ave, Hoffman Estates, IL 60195.

Circle No 423

Cables, accessories detailed

This 14-pg catalog covers cables and cable accessories. Data-cable types include RS-232C, RS-232C extended (to 500 ft), UN shielded multiconductor, and low-capacitance shielded multipair. Other cable types described are 93Ω, 75Ω, twinaxle, and plenum. Among the accessories listed are connectors, hardware, tools, and gender changers.

Craig Data Cable Co Inc, 652 Glenbrook Rd, Stamford, CT 06906.

Circle No 427

Brochure features Europackaging systems

Vector Europackaging is a 4-color brochure that includes technical specifications and features, outline drawings, dimensions, and photographs of the company's line of Europackaging systems. Comprising five product-specific bulletins, it covers custom subracks, backplanes, and individual components; VME backplanes and extenders; Europackaging subracks and subrack dividers; and Eurocard prototyping boards (VME and Multibus II). The brochure also contains ordering information.

Vector Electronic Co, Box 4336, Sylmar, CA 91342.

Circle No 425

Catalog of surface-mount parts

This 28-pg brochure on surface-mount devices describes surface-mount technology and its development and the advantages it offers over through-hole mounting. The document provides package drawings and information on thermal characteristics and reliability for the manufacturer's surface-mount parts; plastic leaded chip carriers and pin grid arrays are highlighted. Product descriptions and availability information are given in tabular format. The catalog also includes pinout diagrams and a short section on designing for testability.

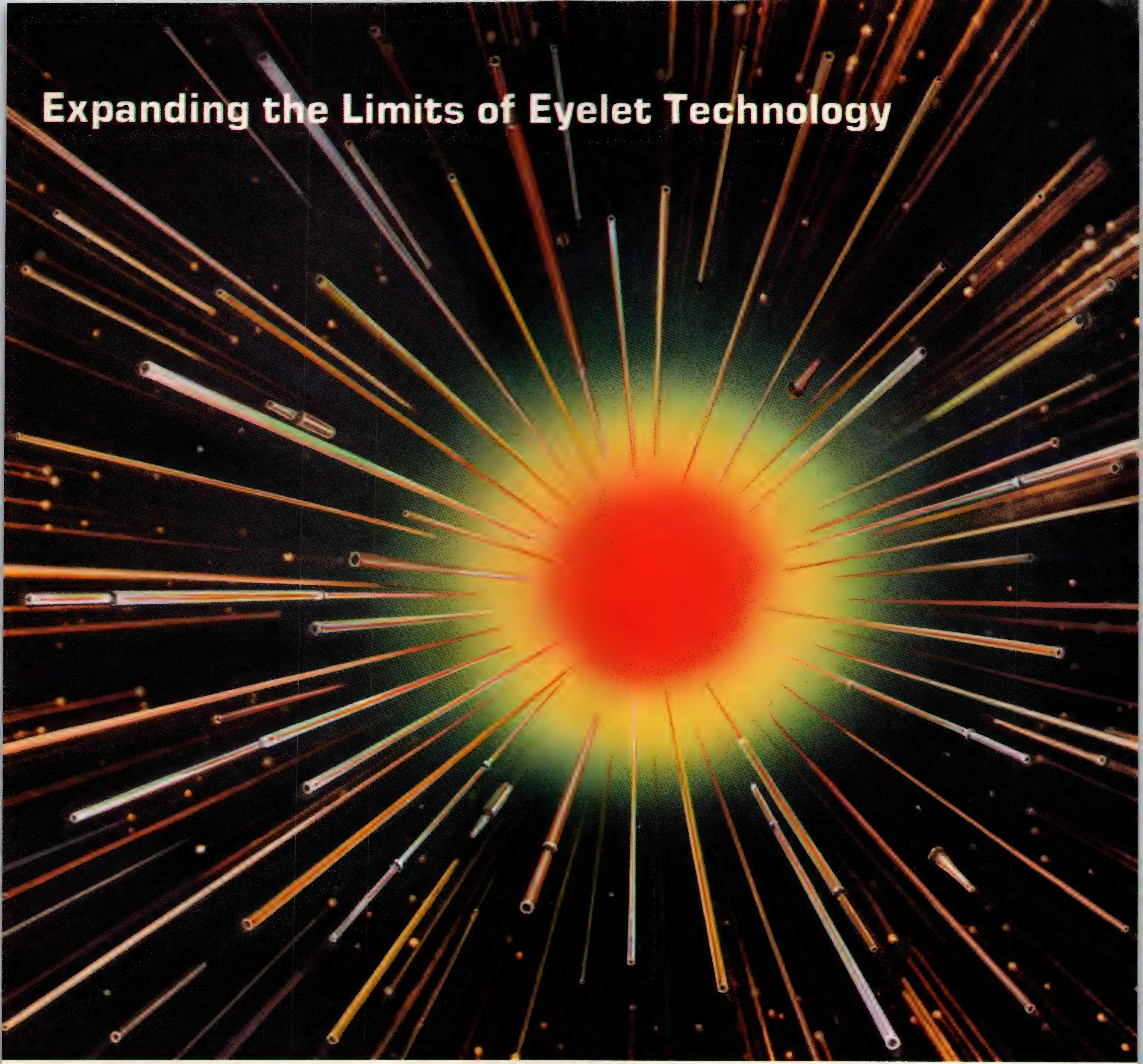
Monolithic Memories, 2175 Mission College Blvd, Santa Clara, CA 95050.

Circle No 426

INSULATION DISPLACEMENT CONNECTORS
Carrot Components Corporation

Insulation-displacement connectors covered

Insulation Displacement Connectors is a 20-pg catalog that discusses the company's line of IDCs. It in-



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CIRCLE NO 174

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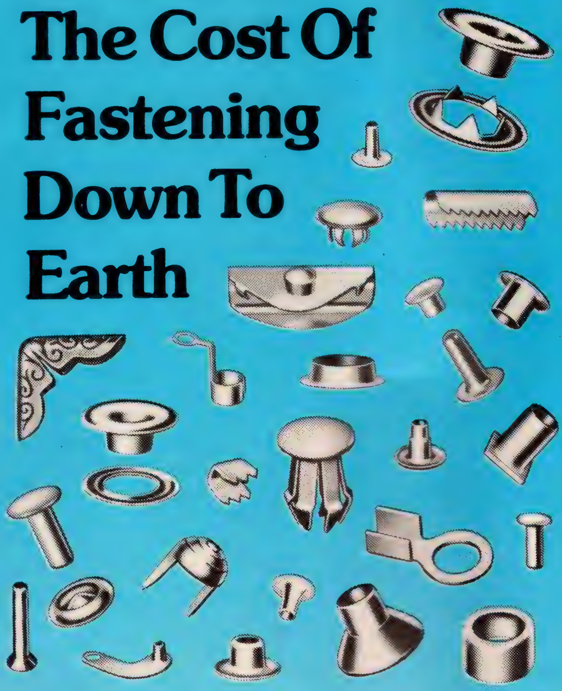

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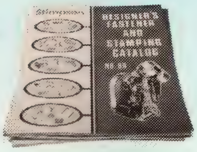
Send a sample of your product, assembled or not. Our Assembly Service experts will analyze and assemble it with the right size, style and finish eyelet or other fastener and recommend the fastening machine best suited to your application ...with substantial savings, just as they've done for years, for so many others. No charge of course.

Send today for your free copy of our latest Designer's Catalog. Illustrating over 1,000 Standard Fasteners and Stampings, plus a full line of automatic attaching machines.



Stimpson Co. Inc.

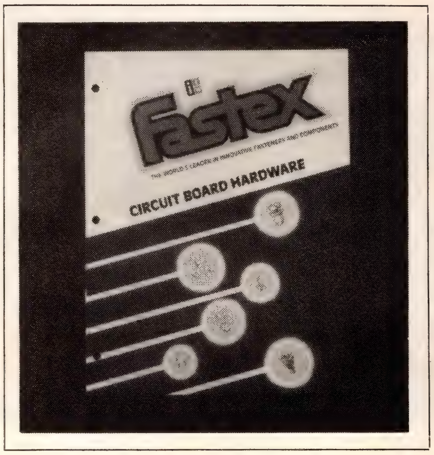
900 SYLVAN AVE. BAYPORT, NY 11705-1097
(516) 472-2000

CIRCLE NO 175

cludes features, dimensions (measured in inches and millimeters), electrical and mechanical specifications, materials and finishes. It also provides ordering information. Products covered include low-profile, protected, and unprotected (pin-strip) headers; socket connectors; 2- and 4-row pc-board transition connectors; and a DIN 41612 connector. Also described are 9- to 50-position D subminiature connectors, plastic and metal backshells, hardware, and accessories, as well as planar IDC cables (extruded gray, color coded, twisted pair, and jacketed shielded). Each product category includes photos and drawings.

Carrot Components Corp, 750 W Ventura Blvd, Camarillo, CA 93010.

Circle No 428



Catalog describes circuit-board hardware

An 8-pg catalog, *Circuit Board Hardware*, features the manufacturer's components suitable for use in mounting, stacking, spacing, and insulating pc boards. It lists styles of circuit-board supports, angle brackets, press-fit screw terminals, and grommets. In addition to including photos and tables of specifications, the catalog highlights the components' key features. It is 3-hole punched for loose-leaf filing.

ITW Fastex, 195 Algonquin Rd, Des Plaines, IL 60016.

Circle No 429

HONEYWELL SPT SETS THE PACE FOR HIGH RESOLUTION GRAPHICS!

Product	Resolution	Guaranteed Performance
HDAC34020	Triple 4-bit TTL Compatible	100 MWPS
HDAC10180B	8-bit	165 MWPS
HDAC10181B	8-bit w/reference	165 MWPS
HDAC34010	Triple 4-bit ECL Compatible	200 MWPS
HDAC97000	8-bit	200 MWPS
HDAC10180A	8-bit	275 MWPS
HDAC10181A	8-bit w/reference	275 MWPS
HDAC51400	8-bit w/reference	385 MWPS

MWPS (Megawords Per Second) is the digital update rate.

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Honeywell Signal Processing Technologies (SPT) brings you high-speed DAC technology that's easy to design-in without the need for additional costly parts.

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Colorado Springs, CO 80906
303-577-1000 Telex #452433

Guide covers power-line protection devices

How to Correct Power Line Disturbances is a 16-pg booklet on devices that you can use to protect power lines. It contains descriptions of typical isolation transformers, line voltage regulators, line conditioners, motor-generator sets, and uninterruptible power supplies. A guide for determining the economical justification of protective devices is included.

Dranetz Technologies Inc, Box 4019, Edison, NJ 08818.

Circle No 445

Design power modules

Using this kit of templates and layout grids, you can design power modules that provide 10 to 600W. The manufacturer will build the device a few weeks after you submit the design. The kit lets you design single- and multiple-output modules and switching or linear-programmable types. The full-scale templates let you design modules that fit into standard rack drawers. You can provide a front panel with as many as eight subpanels containing such devices as meters, LEDs, and circuit breakers. You can lay out the back panel with I/O connectors, barrier strips, or custom connectors. A pricing guide is included.

Kepco Inc, 131-38 Sanford Ave, Flushing, NY 11352.

Circle No 444

Manual examines power-supply design

This 750-pg power-supply application manual uses a textbook-type approach to the subject of power-supply design. Divided into three sections, the book covers technical information (including formulas), application information, and device-selection information.

The manual covers high-power monolithic regulators and voltage- and current-mode PWM controllers. It also contains data on linear regulators (from power-supply design basics to low-drop voltage regulators) as well as high-voltage transistors. The manual has an alphanumeric index and includes packaging information. It also includes mechanical and thermal data on semiconductor parts for power-supply applications. $10.

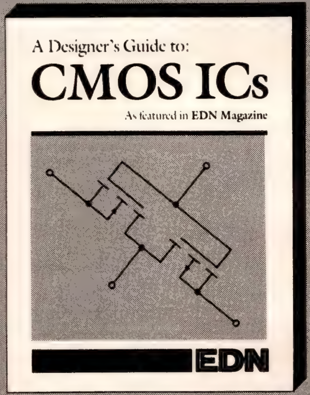
SGS Semiconductor Corp, Literature Response Ctr, 1000 E Bell Rd, Phoenix, AZ 85022.

INQUIRE DIRECT

Brochure highlights dc/dc converters

Describing the manufacturer's line of 50 and 60W low-profile dc/dc converters, this 4-pg, 4-color brochure provides electrical and mechanical specifications for the WRK Series.

SEE WHAT A *DIFFERENCE* CMOS MAKES!



CMOS is fast becoming the chosen technology for developing integrated circuits. That's because CMOS ICs are able to implement ultra-complex system-level functions on a chip!

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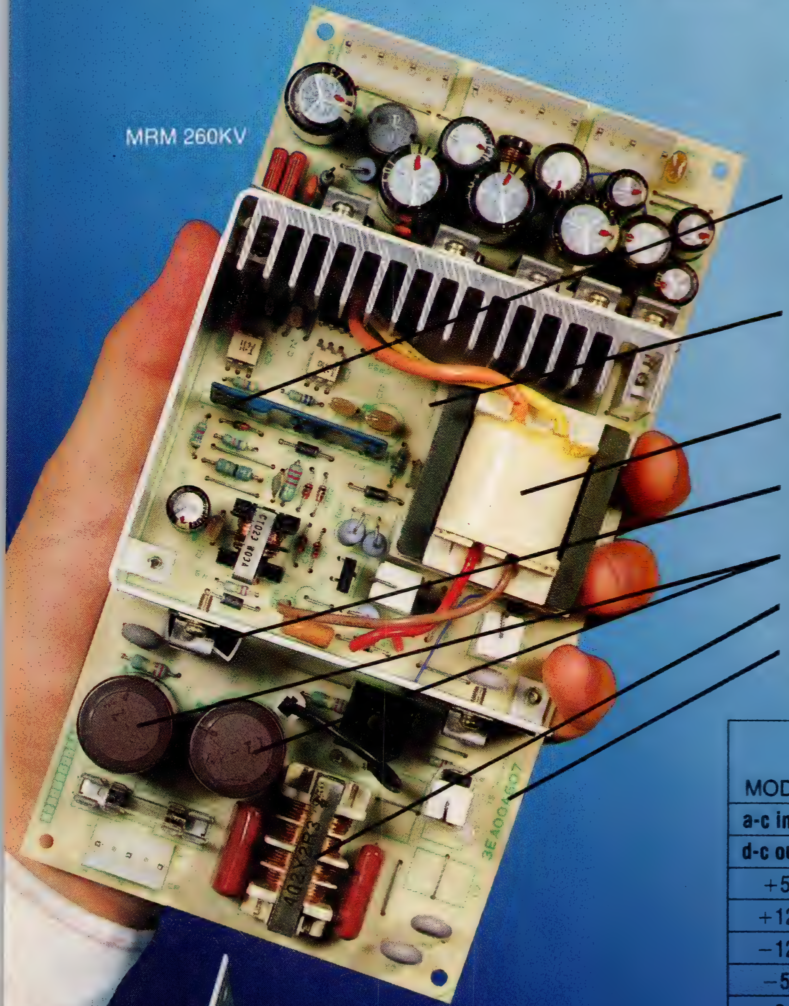
3 MORE KEPCO/TDK SWITCHERS PROVE THAT LOW-PRICED DOESN'T HAVE TO MEAN CHEAP.

Our popular Series MRM — compact, multi output, PC Card switching power supplies for the logic, display, communications, and disk drive requirements of CRT terminals and microcomputers — now has five TÜV-certified members. The power range of the series has been extended to 120 Watts, as the 40-Watt MRM 144KV and the 60-Watt MRM 250KV are joined by the 80-Watt MRM 260KV and the 120-Watt MRM 270KV and MRM 280KV.



Like all Kepco/TDK switching power supplies, their prices are surprisingly low. But they offer all the most-needed features and possess all these well-known Kepco/TDK hallmarks of quality:

Hybrid microcircuits, designed and manufactured in-house, provide control, OVP, current limit, and start-up functions. They greatly reduce parts count and improve MTBF.

8mm primary-secondary, 4mm primary-to-ground spacing for the safety requirements of IEC 380/VDE 0806. All these power supplies have been certified by TÜV Rheinland, and are UL Recognized, CSA Certified.

Transformers of TDK H7C1 ferrite meet the 3750V withstand test of VDE 0806/IEC 380. All chokes also have TDK H7C1 cores.

100KHz switching for fast response, lower EMI, high efficiency, and smaller transformers and chokes.

105°C input capacitors, which store enough energy for at least 20 milliseconds holding time.

Input filters of our design and manufacture attenuate conducted EMI below FCC 20780 Class B.

All components mounted on PC board by machines developed in-house.

MODEL	MRM 144KV	MRM 250KV	NEW! MRM 260KV	NEW! MRM 270KV	NEW! MRM 280KV
a-c input	115/230	115/230	115/230	115/230	115/230
d-c outputs					
+5V	0.45-5.0A[1]	2.0-6.0A (I_1)[2]	3.0-8.0A	3.0-15A	3.0-11A
+12V	0.3-2.5A[1]	0.5-3.0A (I_2)[2]	0.5-3.0A	0.5-5.0A[3]	0.5-5.0A
−12V	0-0.5A[1]	0-1.0A	0-0.7A	0-0.7A	0-0.5A
−5V	—	0-0.5A	0-0.3A	0-0.3A	—
+24V	—	—	—	—	0.3-1.3A (1.7A peak)
Prices*	$80	$99	$130	$185	$185

(1) The maximum combined power for all three outputs is 40W (0-50°C).
(2) Maximum current, $I_1 + I_2 = 8A$. (3) 8.0A peak.
*Substantial OEM discount available.

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CIRCLE NO 177

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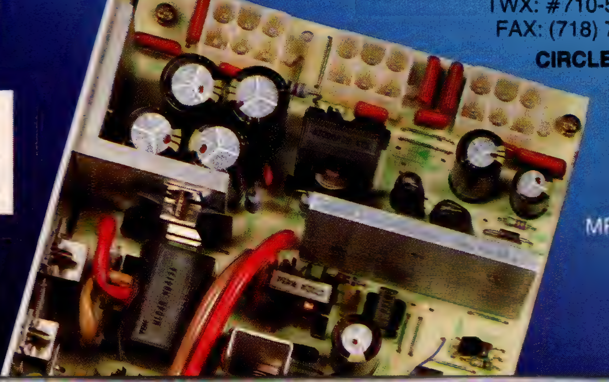
THE POWER SUPPLIER™



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Model RT02-0603-1
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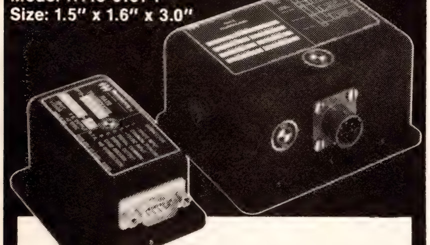

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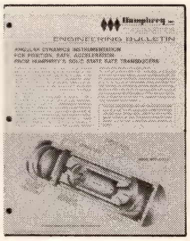
WRITE FOR ENGINEERING APPLICATIONS BULLETIN

Describes various circuits that can be added to sensor to allow use as angular position, rate, or acceleration transducer.



Manufactured under license from Hercules, Inc., U. S. Patent 3,500,691

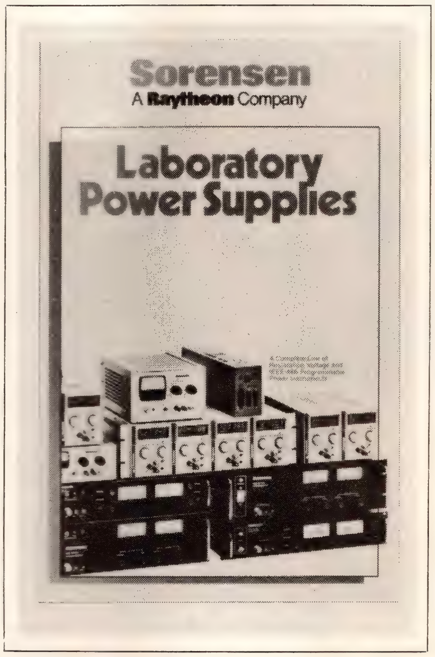
Humphrey Inc.

CIRCLE NO 178

The line features single-, dual-, triple-, and quadruple-output models that maintain full output power to 55°C without the use of a heat sink.

Computer Products Inc, Power Conversion Group, 2900 Gateway Dr, Pompano Beach, FL 33069.

Circle No 446



Sorensen
A Raytheon Company

Laboratory Power Supplies

Specs for lab power supplies

Laboratory Power Supplies, a 4-pg brochure, describes key features and specifications for 58 of the manufacturer's resistance, voltage, and IEEE-488 programmable power supplies designed for laboratory and industrial applications. Among other products, the pamphlet describes the new listener/talker 488 Micro DAP D/A interface unit for computer control of power supplies. This quarter-rack programmer accepts ASCII commands and responses in two languages—the standard Mate/CIIL language and a company language.

Other new products covered include XT Series programmable, 60W linear supplies. Tables and data also highlight the QRD, SRL, and DCR-B Series laboratory supplies.

Sorensen Co, 676 Island Pond Rd, Manchester, NH 03103.

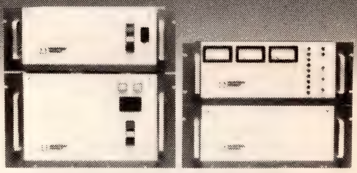
Circle No 447

Whatever your application for high voltage power supplies our technology can deliver

Even such demanding high voltage power supply applications as ion implantation and lasers, may be satisfied by the new and compact Series 4800.

For this system's design brings both flexibility and high stability; capable of providing controlled continuous d.c. output at up to 4.8 kW with a choice of positive or negative polarity.

Rated voltages span 20 kV-80 kV as standard, (up to 200 kV with a HV multiplier disc system).



But if your need is for a laboratory or general purpose supply, you may still benefit from our leading edge technology. For we have models to match all requirements.

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First European High Voltage Manufacturer to hold Defence Standard 05-21.

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51061

CIRCLE NO 179

Brochure guides purchasers of PC-based CAD/CAE

How to Buy CAD/CAE for Personal Computers contains lists of questions that you should ask PC-based CAD/CAE vendors. Areas covered include quality of personal-computer hardware, schematic-capture capabilities, size and types of libraries, and features of pc-board layout software. Detailed questions probe such issues as types of graphics controllers and quality of logic simulators. The 31-pg booklet concludes with a table that lists this company's answers to some of the questions in the brochure.

Aptos Systems Corp, 4113 Scotts Valley Rd, Scotts Valley, CA 95066.

Circle No 430

Kit prepares engineers to design with PLDs

The *PAL Starter Kit* teaches PLD programming. The kit contains four PLDs from Texas Instruments (TIBPAL16L8-12, TIBPAL16R4-12, TIBPAL16R6-12, and TIBPAL-16R8-12) and a modified version of the CUPL programming language. (The version in the kit programs only the four TI parts included.) The kit includes five floppy disks that instruct uninitiated users in PLD programming. Also included in the kit are a 40-pg booklet about using PLDs, product specs for TI's Impact PAL devices, and a CUPL manual. The disks run on all IBM PCs and compatible computers. $49.95.

Personal CAD Systems Inc, 1290 Parkmoor Ave, San Jose, CA 95126.

INQUIRE DIRECT

Newsletter focuses on microwave and RF design

The February issue of this company's newsletter, *EEsof's Fables,* features descriptions of CAE software for designers of microwave and RF products. Typical articles discuss such tasks as circuit simulation of microwave designs and layout of microwave filters. The 6-pg newsletter also addresses customer-support issues and developments in the company's support group.

EEsof Inc, 31194 La Baya Dr, Westlake Village, CA 91362.

Circle No 431

EEsof FABLES

Microwave SPICE™:
CAE Tool for Non-Linear Circuit Analysis

Brochure outlines programs for planning resources

Designed to enhance IBM Copics manufacturing resource planning, each program in the 5-pg *Power+ Supplemental Programs* brochure improves manufacturing productivity and reduces operational costs. The illustrated brochure explains how these programs help Copics users plan manufacturing resources by giving them systems of control that provide timely information. Two programs perform cost calculations; a third program improves communication on a factory floor. Other programs feature bills of materials, purchasing and plant reporting, and inventory valuation.

Bell & Howell, Information Services Div, 2231 Howard St, Evanston, IL 60202.

Circle No 435

Audio tape describes PC-based CAE workstation

An audio tape, *CAE Users' Questions*, features applications for this company's IBM PC-based CAE workstation. You can learn about CAE from 60% of the tape; the remaining portion covers the company's products. CAE instruction includes hints on how to select the right computer system.

Chancellor Computer Corp, 1101 San Antonio Rd, Mountain View, CA 94043.

Circle No 436

Four PC-compatible disks teach PLD design and test

A set of four floppy disks demonstrates this company's Vista schematic-capture package, the Model 160 memory and logic programmer, and the LA 432 logic analyzer. These disks teach you how to create a PLD schematic and convert the schematic to a JEDEC fuse file and a set of test vectors. Instructions cover such devices as EPROMs, EEPROMs, PALs, erasable PLDs, and EPROM-based μPs. The disks also explain how to connect an IBM PC to the company's logic analyzer and perform both state and 100-MHz-timing analyses. All disks include help files. The demonstrations run on IBM PCs and compatible computers having at least 256k bytes of RAM, a graphics card, and either a 640×200- or 640×400-pixel display.

Valley Data Sciences, 2426 Charleston Rd, Mountain View, CA 94043.

Circle No 433

Directory details CAD/CAM software

The *International CAD/CAM Software Directory* offers technical descriptions of manufacturing and engineering graphics packages. The directory indexes all packages by application and company name. Applications covered include data acquisition, engineering calculations, inventory, CAD, manufacturing management, operating efficiency, CAM, CAT, process control, energy management, material and resource planning, linear programming, and shop-floor management. Each listing specifies required hardware, operating system, and minimum memory; price, delivery, and warranty; documentation and technical support provided; and availability of updates and source code. $35.

Technical Database Corp, Box 720, Conroe, TX 77305.

INQUIRE DIRECT

Autorouters explained

This guide describes 10 methods that CAD vendors use to automatically route pc boards. Included are maze, line-probe, pattern, bus, pairwise, multilayer, smoothing, and rip-up routers. The brochure provides a list of features that you should look for in an autorouting package; it also addresses other important issues in pc-board layout such as database management and component packaging. A glossary of layout terms and a list of the steps required to design a pc-board conclude the guide.

Aptos Systems Corp, 4113 Scotts Valley Rd, Scotts Valley, CA 95066.

Circle No 434

Workbook for CAD users

Mastering CAD with the Robo Systems CAD-2 serves both as a self-paced workbook you can use with CAD-2 and as a 60-hour beginner's CAD course. The workbook, which covers all aspects of CAD-2 operation, includes sections on CAD systems, system configuration, system use, menu commands, mechanical drawing, precision drawing, plotters, and printers. $20.

Robo Systems Corp, 111 Pheasant Run, Newtown, PA 18940.

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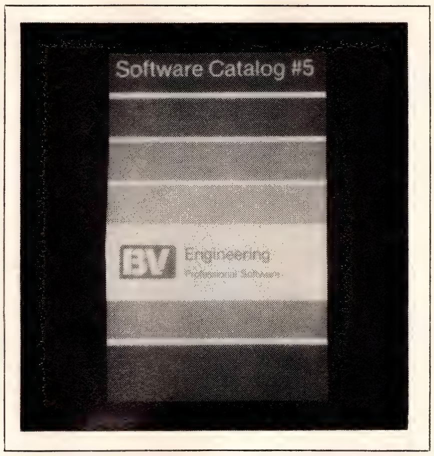
Catalog features software that targets linear design



Programs in *Software Catalog #5* focus on applications that help analog designers. Among the programs in the catalog are packages for transfer-function analysis and synthesis, radio-communications design, ac and dc network analysis, signal processing, and active filter design. Other programs include a Fortran compiler, a scientific calculator, and plotting and editing utilities. The 51-pg booklet concludes with an application note that describes how to use several of the company's programs to analyze a feedback control system.

BV Engineering, 2200 Business Way, Suite 207, Riverside, CA 92501.

Circle No 432

Enhancement products for word processing listed

The *WordStar Accessory Catalog* describes software and publications that aid users of Micropro's WordStar word-processing package. Listings include utilities for laser printing, automatic-footnote and file-management programs, software and publications on customizing the word processor, an on-line thesaurus, packages for merging text and graphics, and keyboard-productivity programs (including Productivity Software International's PRD+).

BroadReach, 534 Industry Dr, Seattle, WA 98188.

Circle No 437

Book and drafting kit aid analog pc-board design

The combination of a textbook and a drafting-aid kit can help you develop your skills in analog pc-board design. The 430-pg textbook, *Analog Printed Circuit Board Design and Drafting*, includes 570 illustrations, which assist you in learning how to create a schematic diagram, select analog components, and analyze your pc-board design. The final project in the text is an op-amp board design. A discussion of the most commonly used drawings and documentation, as well as a description of the art-generation process is included. The drafting-aid kit contains a set of design tools for analog pc-board layout. Text, $59.95; drafting-aid kit, $99.95; both, $149.95.

Bishop Graphics Inc, Box 5007, Westlake Village, CA 91359.

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Manual offers user guides to software products

A comprehensive design-software manual suits both current and prospective users of the manufacturer's Zyp design system. The 760-pg book features user guides on 10 of the manufacturer's Zyp software products. The book also includes reference manuals on four Zyp programs. You must request the book on company letterhead.

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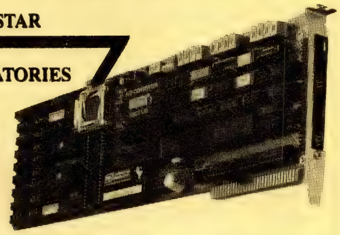

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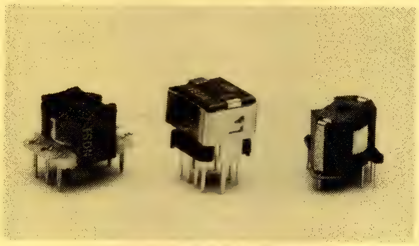

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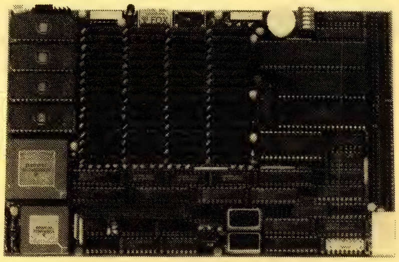

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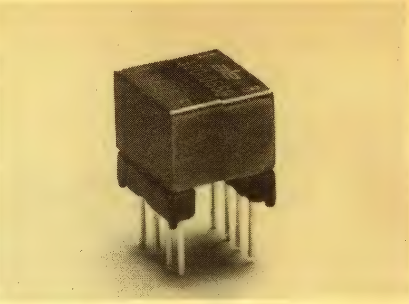

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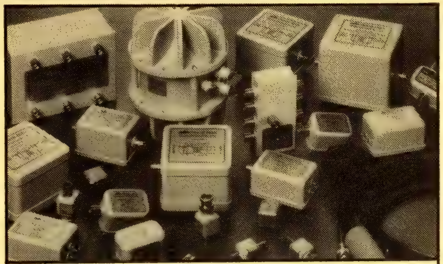

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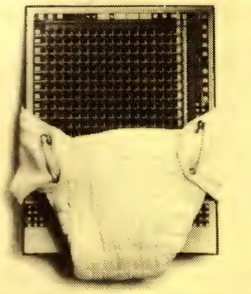

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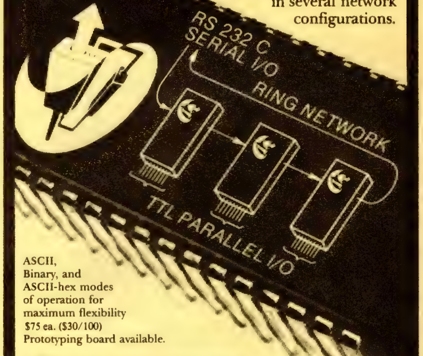

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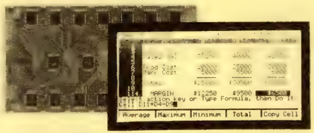

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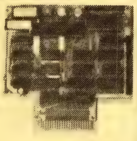

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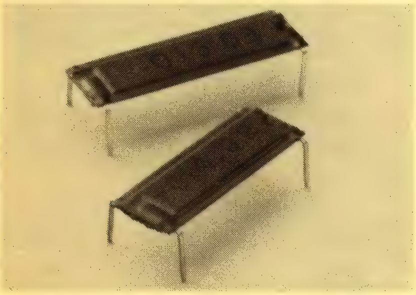

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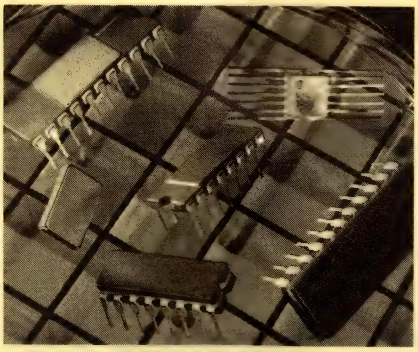

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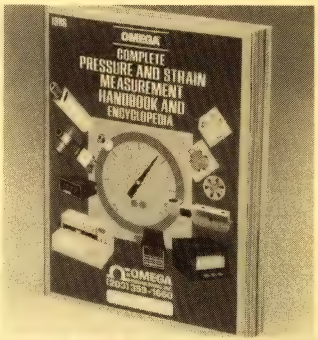

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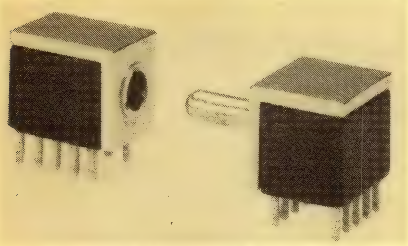

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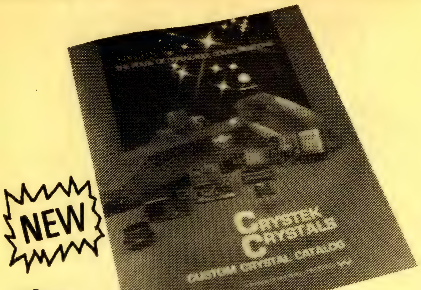

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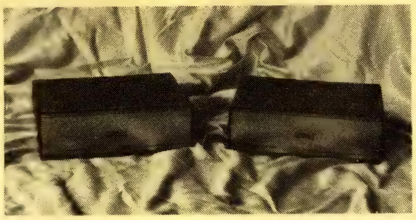

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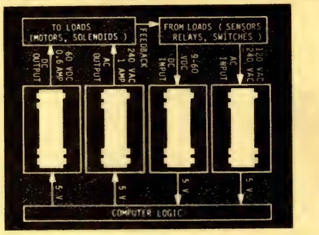

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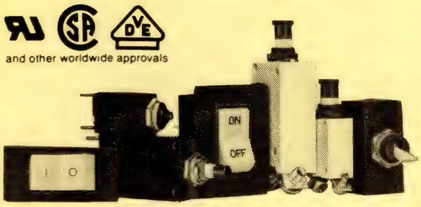

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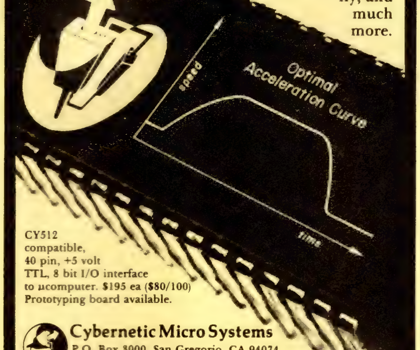

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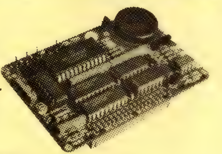

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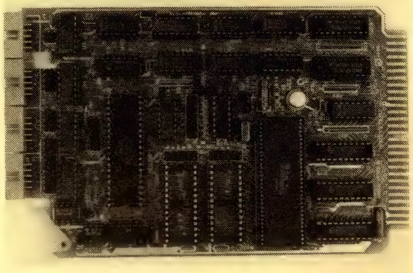

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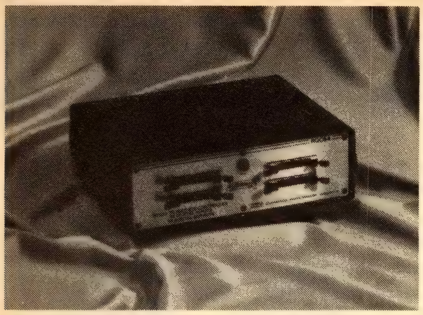

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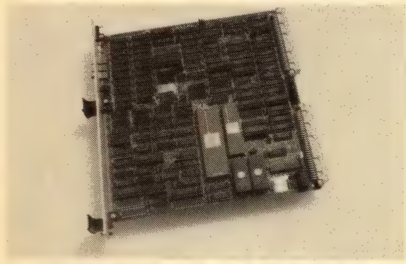

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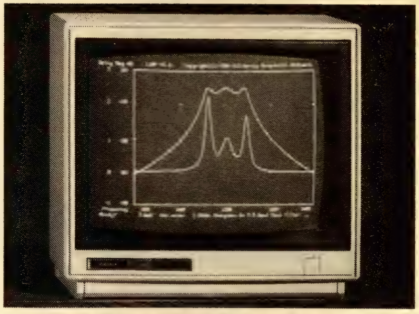

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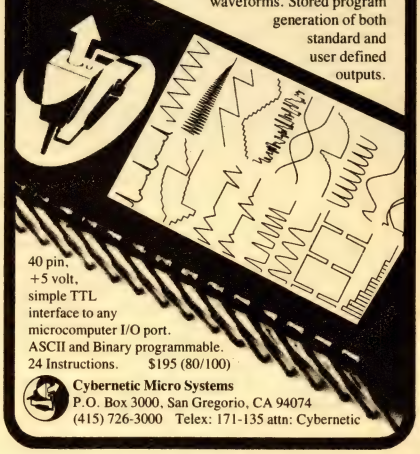

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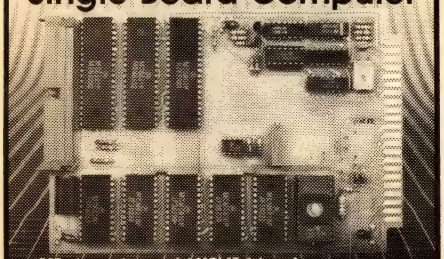

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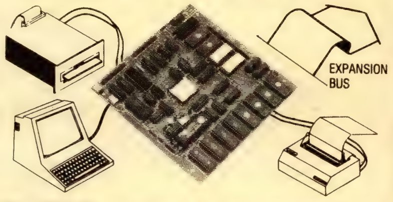

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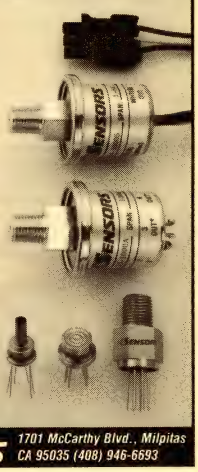

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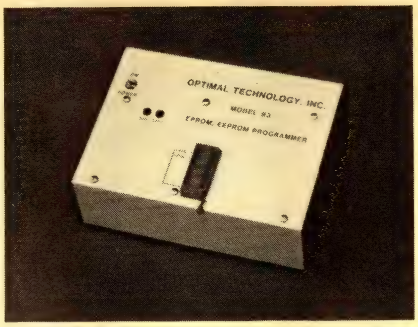

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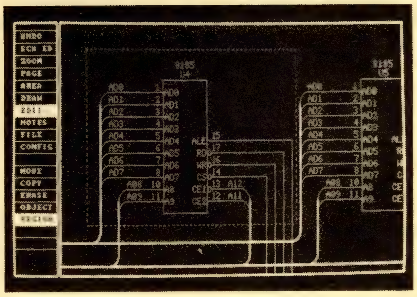

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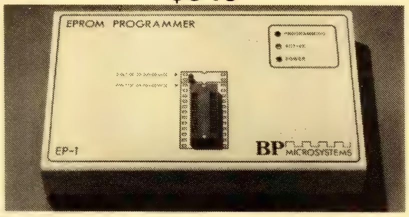

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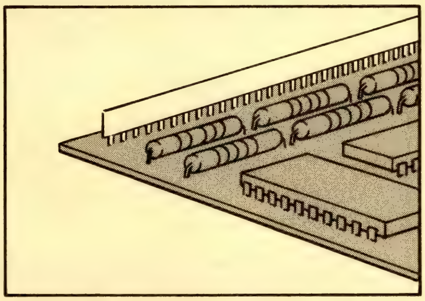

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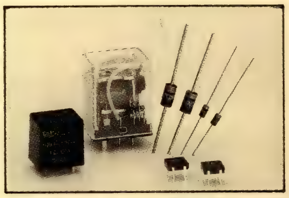

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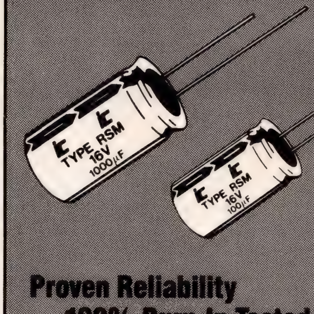

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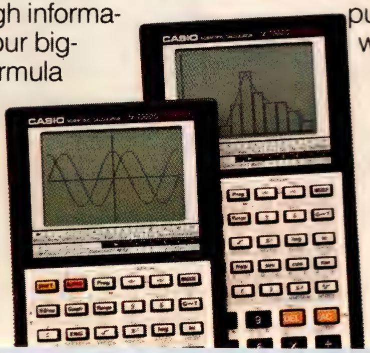

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CIRCLE NO 181

Learning to write well helps engineers overcome anxieties about communicating

Deborah Asbrand, *Staff Editor*

It used to be thought that understanding technology was all that talented engineers needed to do their jobs. But now the task of writing specifications, instructions, technical reports, memos, and sometimes technical papers for conference presentation are integral parts of engineering. As a result, more engineers are taking classes that teach them the basic principles of clear writing and help them get over the uneasiness that often accompanies writing.

Greg West, an engineering-section head at National Semiconductor in Santa Clara, CA, writes frequent memos to upper managers and approximately three technical reports each month. In a previous job as a failure-analysis engineer, he wrote even more frequently—as many as two reports each week. Despite his accumulated wealth of experience, West felt uneasy whenever he began a new assignment.

The hard part: getting started

The biggest problem, he says, was "the agony of sitting down to begin to write. When I was doing failure-analysis reports, I had a set formula to follow. But when I got into writing reports and papers to present at technical conferences, I didn't know where to begin."

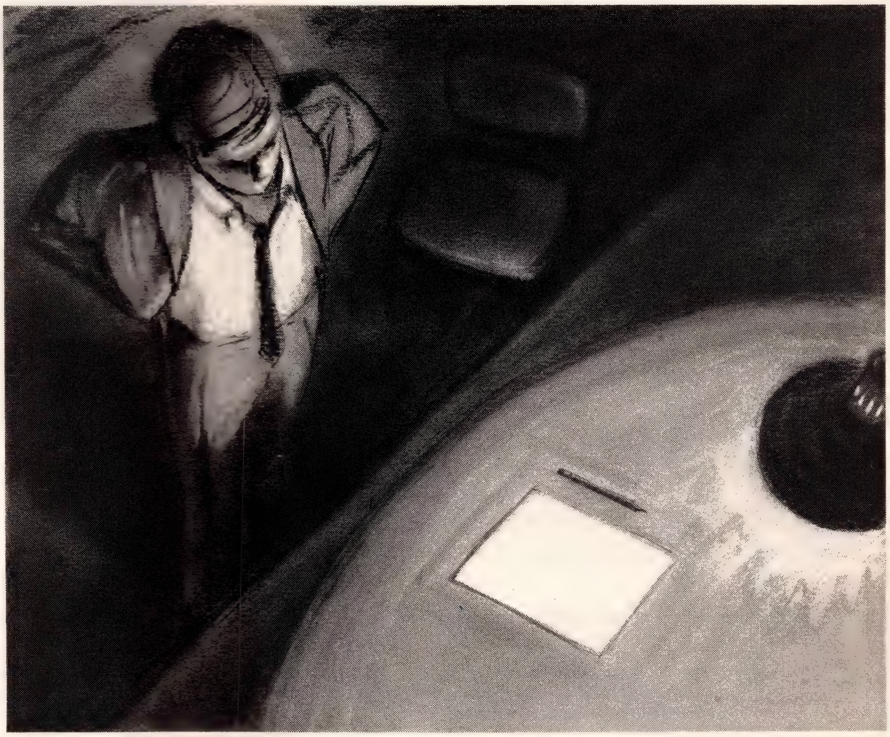
West's discomfort is common among engineers, says Susan Almazol, a senior partner for Communication Training Consultants, a Sunnyvale, CA-based concern that specializes in teaching communication skills to technical professionals. What most engineers look for in a writing class, she says, is a system that takes the mystery out of writing. To accommodate the systematic habits of her engineering students, Almazol teaches them a 3-step process for writing. "Engineers and scientists are methodical, and they're relieved to discover there's a method to writing," she says.

Indeed, West says that once he learned a procedure for organizing the major written points he wanted to convey, he pinpointed his difficulties and doubled his writing efficiency. "I had a tendency to write sentences that were too long and to bury the main point of a paragraph in the middle." West proudly recalls that he recently completed a 4½-page term paper in two hours for a course he's taking.

Another trap that many engineers fall into, says West—and he does not except himself—is letting technical detail obstruct the major points of a document. To avoid this problem, West has changed the way he structures some of his reports. If he prepares a report for his superiors on technical problems that have been encountered on the job, for example, he references the technical problems in the main text and leaves the detailed explanation of the technical problems in the paper's addendum. In this manner, West informs his managers about the problem's causes, manifestations, and possible solutions without weighing down the main points with technical details.

In addition to the improvements he has witnessed in his own written work, West has seen improvement in other aspects of his job. He feels much less nervous when asked to address large numbers of people, he says, because he is more confident in the material he has written and therefore speaks with greater ease.

Like West, R&D engineer Harvey Skinner found that the writing skills he learned at a company-spon-



Paul Schulenburg

sored seminar made his job much easier. Skinner works in the operating-systems laboratory at Hewlett-Packard's Computer Systems Division in Cupertino, CA, and his job includes writing memos and documentation for technical end users. He also prepares reports on proposed new products, detailing the reasons why the product is needed and which features it should include.

Although Skinner's previous job was writing software documentation, he still experienced pangs of anxiety before he began any piece of writing. "I'm like everyone," he says. "The worst part is sitting down and getting started." Skinner, a student of Almazol's, says that the most useful exercise for him was critiquing four documents he had already written and discussing how they could have been improved. He discovered he frequently wrote run-on sentences—"the kind that do 'loop-the-loops,'" he says—and added unnecessary words to his sentences. He also became a more frequent user of simple writing aids like a dictionary and a thesaurus. Since taking the course, he says he has become much more relaxed about writing.

Engineers aren't alone

The discomfort that West and Skinner once experienced is not confined to engineers, says Almazol, who is also a lecturer in the engineering management program at the University of Santa Clara. In fact, says Almazol, the writing difficulties that engineers encounter are also found in professionals in a wide variety of fields. She believes they reflect weaknesses in the conventional writing style taught at most colleges and universities. "Engineers are a lot better at writing than their reputation suggests," she says. "The reason they have problems is because schools don't teach business writing, they teach you how to write essays. Non-engineers have the same problems as engineers when it comes to writing."

Almazol has mixed feelings about whether the word-processing programs that most engineers and other professionals use are a help or a hindrance to the writing process. "Computers can be a boon to helping people write faster and more easily, but they also make it too easy to send off a piece of writing without checking it," she says. "The more people use word-processing programs, the more I find that their writing deteriorates because they dump the information into the system and don't bother to reread it." **EDN**

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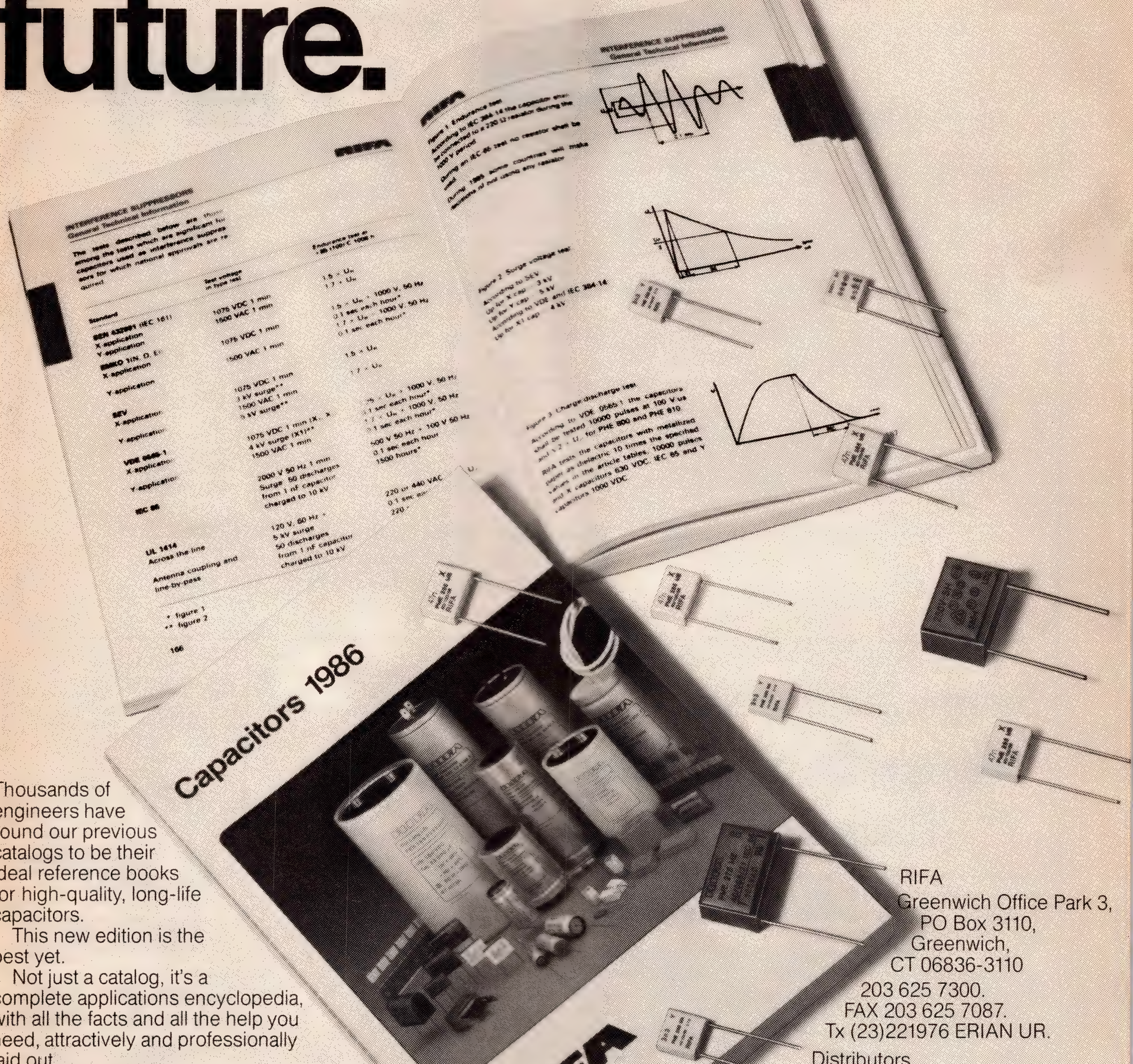

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Sept. 4	Aug. 14	Test & Measurement Special Issue; Oscilloscopes; Automated Design & Engineering for Electronics Product Preview (CAE-related*); Meters; Display Technology	Closing: 9/11 Mailing: 9/23
Sept. 18	Aug. 27	Personal Computer-Based CAE; Power ICs; Computer Peripherals; Hardware & Interconnection Technology; EDN 30th Anniversary Tribute	
Oct. 2	Sept. 11	Surface Mount Technology; Memory ICs; CAE; Semicustom IC Directory (CAE-related*)	Closing: 10/16 Mailing: 10/28
Oct. 16	Sept. 25	Digital Signal Processing; Personal Computers; ICs; Test & Measurement Instruments; Display Technology	
Oct. 30	Oct. 8	Batteries; Converters; Wescon '86 Product Preview; European Electronics; Computer Boards	
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ERIM REPORT #4

The Science of Range-Doppler Imaging

Fundamental range-Doppler radar imaging methods developed at ERIM are providing new capabilities in a variety of applications.

Range-Doppler Imaging

Fine Resolution microwave or laser images of objects which are rotating with respect to the radar system can be formed using the principles of range-Doppler imaging. Range resolution for such a system is provided by ranging with wideband waveforms subjected to pulse compression to accurately measure distance to the scatterers of interest. Cross-range, or azimuth, resolution is provided by performing Doppler-frequency spectral analysis (FFT) within range bins. Signals with higher Doppler frequency content are associated with scatterers of greater line-of-sight velocity which in turn implies increasing cross-range offset from object center. Display of the range bins and Doppler-frequency cells within range bins in a rectilinear grid results in a reflectivity image of the rotating object or scene.

With this approach, finer azimuth resolution is obtained by performing the Doppler spectral analysis over increasing time intervals. However, as one strives for finer resolution the integration time can become so long that individual scatterers begin to move through the image resolution cells that one is attempting to form. In such a case the resultant image quality actually degrades with increased integration time.

Polar-Format Algorithm

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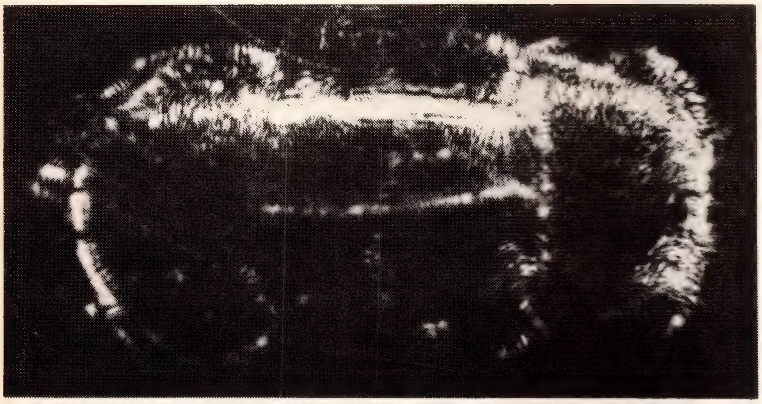
Applications

Fine-resolution range-Doppler imaging is applicable to a number of situations, including space object imaging (SOI), Inverse Synthetic Aperture Radar (ISAR), and Spotlight-mode SAR for airborne imaging of ground scenes. In principle, the approach is suited to both optical and radar wavelengths, Also, the theory has been extended to allow for three-dimensional imaging of objects given suitable signal collection configurations.



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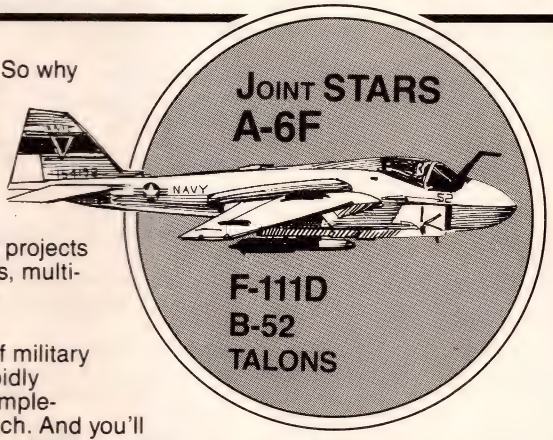

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EDITED BY GEORGE STUBBS

Keyboard sales to exceed $1.5 billion in 1990

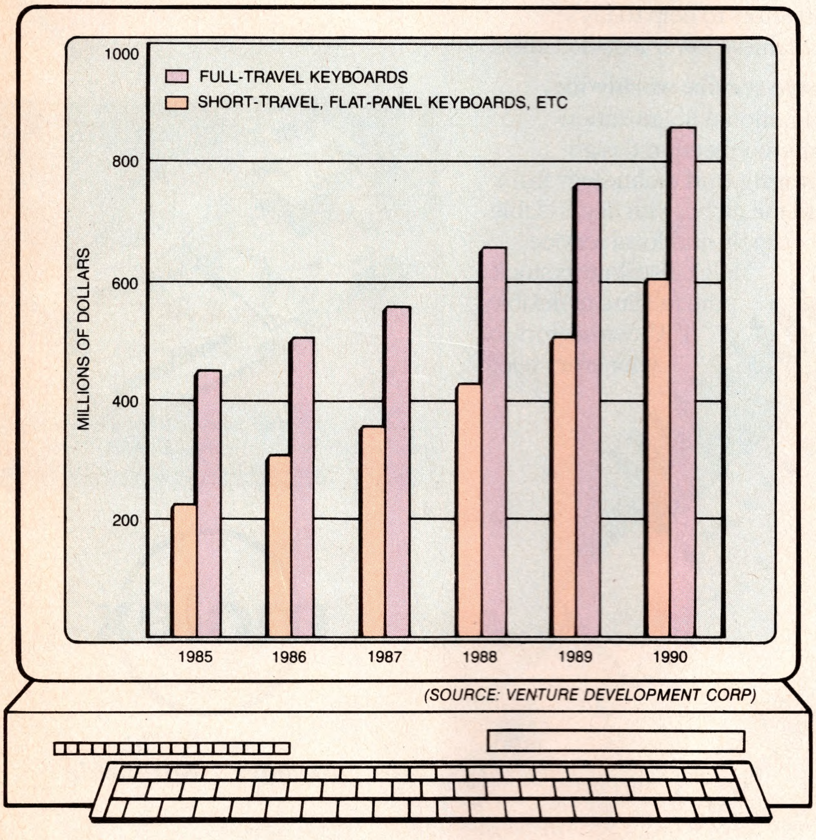
Valued at $699 million in 1985, the keyboard market is expected to maintain a rapid rate of growth—16% annually, according to the market-research company Venture Development Corp (Natick, MA). In 1990, keyboard sales should be in excess of $1.5 billion. The cited rate of growth is an average of disparate growth rates in the two main segments of the market: Short-travel keyboards will gain in popularity while full-travel units will see much more modest growth.

Keyboards come in many forms for a wide range of applications, from computers and electronic toys and games to instrumentation and machine tools. Still, it's possible to classify them in two general categories. Full-travel keyboards (travel is the distance a key must be depressed to engage the desired function) are the familiar ones associated with personal computers and workstations; the travel is typically 0.12 in. The other group goes by a variety of names—short-stroke keyboards, short-travel keyboards, touch panels, flat panels; the key switches of units in this group can feature a limited, but noticeable, travel or travel that's scarcely discernible at all.

Though the applications for full-travel keyboards are reasonably well defined, the average person could hardly have failed to notice the appearance of touch panels in a variety of new contexts. It should come as no surprise, then, that the market for short-travel keyboards will grow at a much faster rate than that of full-travel keyboards—20% vs 11.9% annually through the remainder of the decade. The market share of full-travel units was 69% in 1984, but that figure will fall to 59% by 1990.

Developments in membrane and conductive rubber keyboards will continue to inspire new uses for short-travel keyboards. Development efforts in the keyboard market generally will tend to focus on lower costs, more stylish appearance, and ruggedness.

SALES OF FULL-TRAVEL AND SHORT-TRAVEL KEYBOARDS



(SOURCE: VENTURE DEVELOPMENT CORP)

Publishing systems sales to top $7 billion by 1989

The corporate electronic publishing system (CEPS)—a network of electronic equipment that rapidly produces printed reports and documents—has become a major segment of the computer industry, according to the research, forecasting, and strategic-planning company InterConsult Inc (Cambridge, MA). The CEPS industry segment is poised for rapid growth through the remainder of the decade. Sales of CEPS equipment totaled $3 billion in 1985, a figure that will grow to $7 billion by 1989.

Of the nearly quarter of a million US concerns that are prospective purchasers of CEPS equipment during the next five years, business-services companies, with their obvious need for sophisticated report-generation equipment, will represent the largest buyer segment. The computer and electronics industries together will form the second largest segment, using electronic publishing systems to create product documentation in a timely manner. Though companies in the aerospace and automotive industries represent only 2% of all prospective purchasers, their needs are great, and they should account for 16% of the CEPS equipment dollar value between 1987 and 1989.

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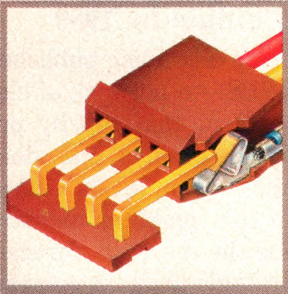

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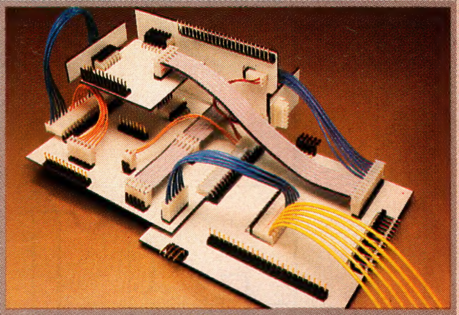

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CIRCLE NO 184

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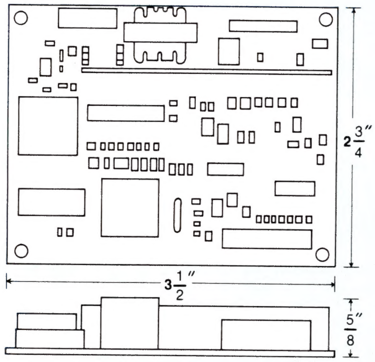

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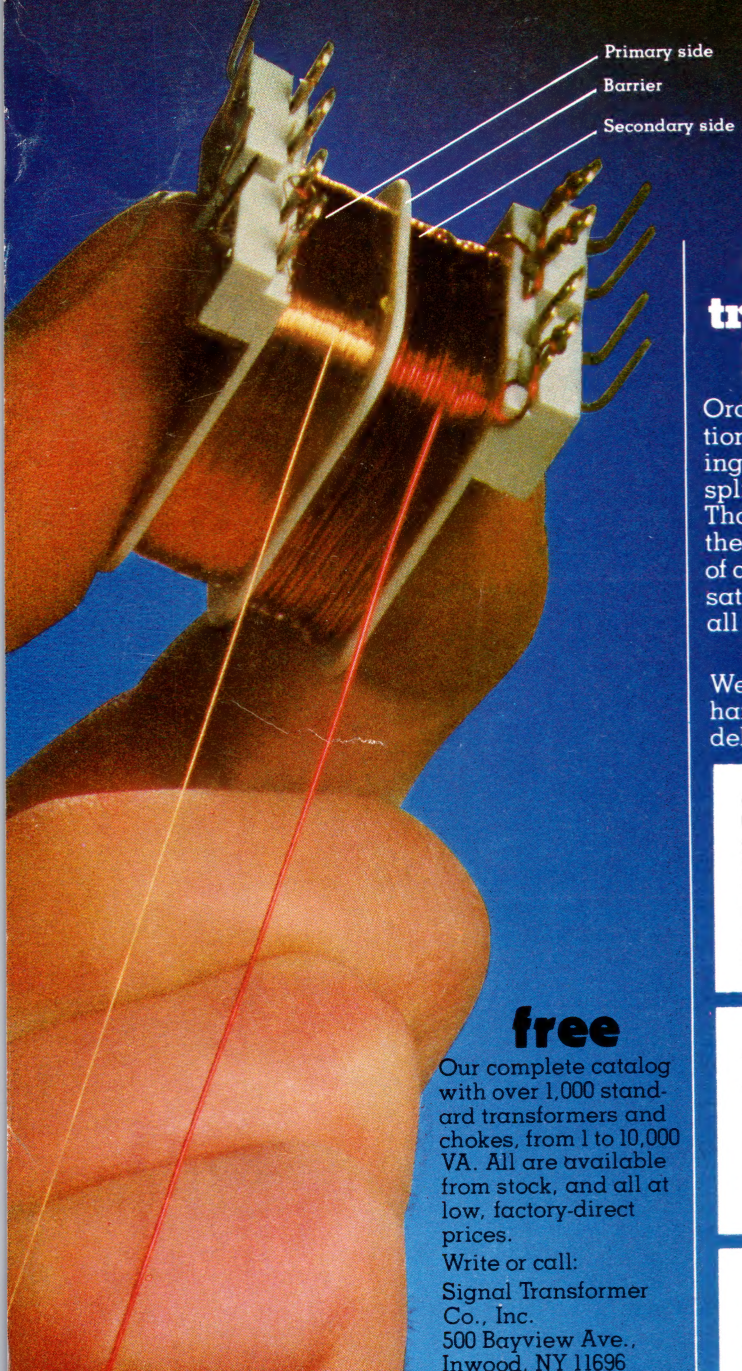

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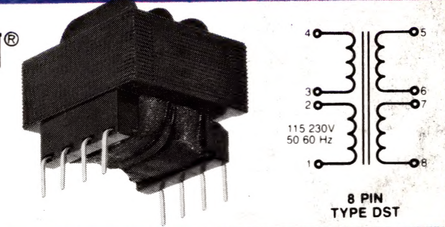

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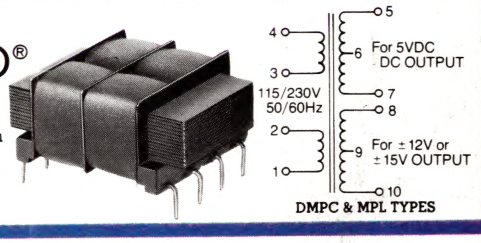

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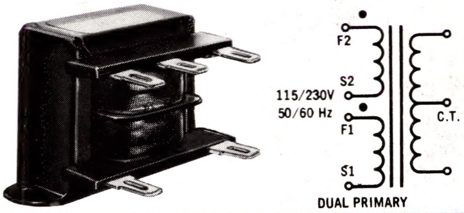

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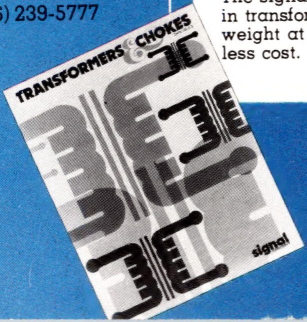

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